CYCLONE MEMOIRS.

PART II.

BAY OF BENGAL CYCLONE

OF

August 21st—28th, 1888.

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BAY OF BENGAL.

CYCLONE MEMOIRS, PART II.

ACCOUNT OF THE CYCLONIC STORM OF AUGUST 21st to 28th, 1888.

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INTRODUCTION.

THE present paper is written with the intention of giving a full description of the formation and history of a very violent cyclonic storm which passed through Bengal from August 21st to 28th, 1888. The storm was undoubtedly one of the class which usually forms during the rainy season in the Bay of Bengal, and not of the class of the fierce cyclones which are generated at, what are called, the transitional periods, *i.e.*, from April to the end of May, and from the middle of September to the beginning of November. But though it was of the feebler class of storms called the cyclonic storms of the rains, the storm in question was in one quadrant at least of force almost equalling that which is usually experienced in the most destructive cyclones, and was of sufficient force to almost cause the loss of one, if not of two, vessels.

The storm was generated close to the land at the head of the Bay of Bengal, within a few miles of Saugor Island. This area has in its neighbourhood several meteorological observatories, and thus affords an excellent opportunity of watching the meteorological conditions which precede and accompany the formation of such a storm. The northern half of the storm after its formation was well over the land, and was of feeble character, as was also at first all the area near the centre of the storm, but in the southern half which lay over the sea at a considerable distance from land the cyclonic winds were extremely violent, and an attempt is made to account for the more remarkable differences in the wind-force in different parts of the storm which are here indicated. It will be shown that at first the fierce part of the storm was confined to an area from about 90 to 200 miles to the south of the centre, but that as the storm passed inland the area of strong winds gradually closed up and came nearer and nearer to the centre. Another point of importance in the storm was the fact that the centre of the barometric depression was many miles to the south of the centre of the circulation of winds, which fact is perhaps connected with the distribution of the strength of the winds in the storm. The storm was also remarkable for the slight barometric depression which accompanied it when the excessive force of the winds is considered, and was very noticeable for the particularly heavy wave of rainfall which was brought up in its rear. Finally there was another interesting feature in the storm inasmuch as it was formed while there was a second but smaller storm already in existence, which had been for some days travelling across India in a westerly direction.

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[*] These memoirs are written by different members of the department. It is considered best in order to secure enumeration of cyclonic facts and phenomena from different points of view to allow each writer to express his views fully. Hence the writer of each memoir is solely responsible for the theoretical views put forward in the memoir. The Editor hence does not necessarily agree with the views or theories put forward or with the explanation given of the phenomena under discussion.

The storm will be discussed under the following heads:—

Short description of the meteorological conditions in the Bay of Bengal and in Bengal itself antecedent to the formation of the storm.

Detailed description of the weather over the same area day by day from August 15th to the 28th, 1888, inclusive.

Track of the storm.

Discussion of the wind-directions and force over the storm area when the storm was being formed, and for the first two or three days of its existence.

Discussion of the pressure distribution over the storm area during the formation of the storm, and for the first two or three days of its existence.

Short description of the rainfall accompanying the storm and of its distribution.

Concluding remarks.

WEATHER PREVIOUS TO 15TH AUGUST 1888.

The weather of the period previous to the actual formation of the cyclonic storm at the head of the Bay of Bengal in August 1888 had been decidedly abnormal. It is, however, not necessary to deal in detail with the meteorological conditions for any long period antecedent to the storm, for it does not appear that its character was directly connected with the peculiar features of the weather of the year. On the other hand, as one of the abnormal meteorological features in this period perhaps determined the position of the commencement of the storm, it is desirable that the main facts should be placed on record.

From the beginning of the year till the commencement of June 1888 the meteorology of the Bay of Bengal, and of the land area to the north of it, calls for practically no comment, as the conditions were fairly normal in the various seasons. At the beginning of that month the conditions in the Bay and in Bengal were such as usually precede the setting in of the monsoon rains in Bengal, which takes place generally in the second week of the month. In May three successive strong advances of monsoon winds occurred in the Bay. The first advance took place about the 8th or 9th May in the extreme south of the Bay, and in front of this advance, a small cyclonic storm was formed which crossed the Madras coast near Cuddalore on the night of the 11th. The advance then died away without having progressed very far up the Bay. The second advance commenced about the 17th and lasted only for four or five days, and it would appear that in this advance the monsoon winds reached about the centre of the Bay, when they again died away. The third advance of the monsoon current commenced in the south of the Bay on the 27th, and from the 28th exceptionally strong winds were reported at the Ceylon stations, which continued up to early in June. On June 1st, the advance had reached well into the centre of the Bay, and there were no definite indications of any storm having formed in front of the advance. On the 2nd of June, however, a small cyclonic storm commenced to form to the north-west of the Andaman Islands. On the 3rd a distinct storm existed off the West Pegu coast. The small storm then commenced to move in a north-westerly direction, and on the 4th of June it was in the centre of the Bay, and advancing towards the Orissa coast. In its progress, however, it gradually broke up and became more feeble, so that by the morning of the 5th, as it approached the Orissa coast, it had ceased to exist as a definite storm, and a diffused barometric depression only drifted over the head of the Bay and Orissa, giving moderate rain in its advance, which continued for some days up to the 9th or 10th, and spread over the greater part of the province of Bengal.

Up to this period, therefore, all the meteorological indications pointed to the early commencement of the rains in Bengal and in Northern India generally, and in normal years the next advance of the monsoon current would probably have carried the rain-bearing current over the greater part of the province of Bengal. But though strong advances of monsoon winds took place in the south of the Bay for some days after the 6th, and from the 17th, and from the 21st, rainfall remained almost practically absent from the whole of Bengal up to the 27th or 28th of June. While, however, Bengal was thus almost rainless, excessive rain was being received over Burma and Assam, and from the 22nd to the 29th of June, Dhubri, for instance, received more than 26 inches of rain, while falls of more than 10 inches in a week were reported in several cases. It is clear, therefore, that the monsoon current from the south and centre of the Bay was being deflected to an unusual extent eastwards. The cause of this deflection of the rain-bearing current from Bengal and Northern India towards Burma and Assam appears to have been that a very shallow but persistent barometric depression existed at this period off the Arakan and West Pegu coasts. This was accompanied by a feeble but continued cyclonic whirl or wind circulation, as indicated by the winds at the coast stations, so that the monsoon winds which were blowing to the south of the shallow area of disturbance were given an eastward set, and thus passed over Burma and Assam instead of advancing up the Bay towards Bengal. About the 27th of June however this tendency to the formation of the shallow low pressure area in the east of the Bay ceased, its disappearance being simultaneous with the setting in of the rains in Bengal. At the same time a feeble but distinct tendency to the formation of a low pressure area commenced in South and South-West Bengal. The appearance of this tendency to low pressure, and the consequent cyclonic circulation of winds, simultaneously with the disappearance of these conditions in the Bay was, however, probably merely a coincidence.

This tendency to comparatively low pressure in the southern and western districts of Bengal appears to have remained a distinct feature during the whole of July, as is shown in the following table where the variations of the mean pressure from the normal values for July 1888 are given at 13 typical stations in the province :—

STATIONS.	Variation of mean pressure for July 1888 from the normal.	STATIONS.	Variation of mean pressure for July 1888 from the normal.
	Inch.		Inch.
Cuttack . . .	—·008	Chittagong . .	—·004
False Point . .	—·014	Dacca	—·002
Saugor Island . .	—·011	Purneah . .	—·009
Calcutta . . .	—·021	Durbhunga .	—·006
Burdwan . . .	—·023	Bankipore . .	—·016
Berhampore . .	—·017	Hazaribagh . .	—·004
Jessore . . .	—·010		

Pressure, it will therefore be seen, was in comparative defect at Calcutta and Burdwan.

This fact seems to have been of importance in determining the area over which the barometric depressions in July were generated, for on July 1st a feeble depression was formed over Western Bengal near Ranigunj, which afterwards moved in a north-westerly direction through Behar. On the 5th July, a tendency towards a cyclonic circulation of winds appeared over parts of Western and Central Bengal, probably connected with a slight depression, which afterwards moved in a westerly direction through Chutia Nagpur. Later on, about the 12th, a small cyclonic storm was formed off the south part of the Orissa coast, which crossed the coast between Pooree and Gopalpur early on the 14th.

The effects of this small storm having passed away, another depression was formed on July 19th, the centre of the depression being close to the Sunderbuns and to the south-east of Saugor Island. The small storm was accompanied by a distinct cyclonic circulation of winds, but the wind-force was not large at the coast stations, though the pilot brigs at the Sandheads seem to have experienced a hard gale of wind, and squally weather generally obtained over the northern half of the Bay. The small storm commenced to advance inland on the 19th, the centre passing close to Saugor Island, and afterwards advanced in a north-westerly direction. It apparently filled up on the 23rd after it had travelled into the North-Western Provinces to Allahabad. Again, on the 29th July, a feeble low pressure area was developed over part of West and South-West Bengal, accompanied by a cyclonic circulation of winds, the centre of which was near Burdwan. This depression afterwards advanced in a north-westerly direction passing through Behar, and out of the province of Bengal.

It will thus be seen that out of five disturbances in July 1888 (one feeble and four more important), four were generated over the western and south-western districts of Bengal or over the sea-area adjoining. It is a striking instance of the fact that a persistent shallow disturbance or barometric depression may exist over a particular area, from which several small storms may be developed in succession, provided only other circumstances are favourable.

With the succession of small storms just described, the rainfall in Bengal in July was decidedly heavy, and the fall of the whole province was about a fifth larger than usual, while in such districts as South-West Bengal, Chutia Nagpur, and Behar through which these storms passed, the rainfall was nearly a third in excess of the ordinary fall, and an average rainfall of no less than about 16 inches was recorded in these districts during the month.

At the commencement of August, a barometric depression was formed close to Saugor Island, and on the 4th the centre of the depression and of the accompanying cyclonic circulation of winds was to the south-east of that station. It continued to exist as a feeble, but remarkably persistent storm, and remained almost unchanged in position and intensity in the north-west angle of the Bay for four days, the centre very gradually drifting to the south and south-west of Saugor Island up till the 8th, when it was close to the coast. On the morning of the 9th it had advanced inland, and was to the south-west of Calcutta. During this day the storm continued to move in a westerly direction, and on the morning of the 10th the centre was in the Singbhoom district of Chutia Nagpur near Chyebassa, but the storm had then become decidedly more feeble, and subsequently filled up. On the 11th of August a very rapid fall of pressure took place in South-West Bengal, and another small depression formed, the centre of which was between Saugor Island and Calcutta. It was accompanied by a distinct cyclonic circulation of winds, and on the 12th, the area of disturbance advanced into the eastern part of South Behar. On the 13th, conditions remained practically unaltered, but on the 14th a rapid increase took place in the strength of the westerly winds, forming perhaps an extension of the Bombay monsoon current, and the easterly and south-easterly winds which were previously blowing over the greater part of Bengal and Behar, were replaced by westerly and south-westerly winds in all districts except in the extreme east and north of the province. A very rapid increase of pressure also took place in the western and south-western districts, and the area of minimum pressure in the province was transferred to the southern districts of North Bengal, where also there existed at that time a marked tendency to the setting up of a cyclonic circulation of winds. A very important barometric depression was then formed, the history of which will be dealt with in the description of the detailed meteorology of the days immediately previous to the formation of the storm under discussion.

Both these small storms in the early part of August brought up heavy general rainfall to the whole of Bengal and Behar, and rainfall up to the middle of the month continued to be in considerable excess of the normal in all districts except North Bengal and North Behar.

The above description of the meteorology of the few weeks before the formation of the August storm is instructive, as there are certain abnormal features which remained persistent from the end of June till the middle of August. These were, first, the existence of the depression off the Arakan coast which caused the retardation of the rains in Bengal, and with the disappearance of this depression the appearance or formation of a similar depression in South-West Bengal accompanied by a tendency to set up a cyclonic circulation of winds over the area of depression. During July and the first half of August, no less than six small storms, each accompanied by a cyclonic circulation of winds, were formed over this area. Most of them, it is true, were more or less feeble, but one, at least, gave rise to very strong winds at sea. The successive formation of these six storms can scarcely have been a matter of accident, and it is clear that they were connected with the persistent low pressure area in question, even if they cannot be considered to stand in the relation of effect and cause. It was also over the same area that the very severe storm about to be discussed in detail was formed, and hence a connection between the pre-existing abnormal features of the meteorology of the Province with the origin of the cyclone in question may be fairly assumed.

Description of the daily weather from 15th to 29th August 1888.

August 15th.—It has previously been noted that on the 14th August rather rapid changes in the meteorological conditions took place, due to a sudden advance of westerly and south-westerly winds over Bengal and Behar, which drove back the easterly and south-easterly winds previously blowing. This was also accompanied by a rapid increase of barometric pressure over the western districts, and the transfer of a feeble low pressure area which had existed in the eastern part of South Behar to the southern part of North Bengal, and over which also there was a tendency to set up a cyclonic circulation of winds. There was, at this time, little or no trace of the existence of the feeble low pressure area in South-West Bengal which had been previously prominent, but though latent for the time, it is probable that it was not quite non-existent. Rain fell generally and rather heavily on the 14th, and the conditions in Bengal were such as very commonly occur during the monsoon season in Bengal without being followed by any particularly abnormal consequences.

In the following table, which is divided into three parts, are given, in the first part, the daily observations made at the principal stations round the Bay of Bengal; in the second part, those taken on board a few vessels navigating different parts of the Bay, and on board the light ships and pilot vessels at the head of the Bay, and in the third part the observations taken at the inland stations in Bengal, and at a few stations in the North-Western and

Central Provinces. The principal facts as to the barometric pressure and wind directions, &c., are given in Plate VII.

15th August 1888.

Hour.	Position of Station.	Station.	Barometer.			Temperature.	Humidity.	Temperature previous 24 hours.		Wind.				Weather Remarks.
			Actual reduced to 32° and sea level.	Change since previous 24 hours.	Variation from normal.			Maximum.	Minimum.	Direction.	Velocity. Miles per hour.*	Cloud proportion.	Rainfall.	
A.M.	A. Coast Stations.													
9 30	Ceylon	Galle	29·970	+·026	?	[illegible]	95	83·5	77·5	Calm	0	2	0·05	
9-30		Colombo	29·951	+·008	+·023	82·5	75	85·5	77·5	S.-W.	9	6	*Nil*	
[illegible]		Trincomalee	29·875	+·006	?	86·5	03	99·0	77·0	S.-W.	16	4	*Nil*	
8	West Coast Bay.	Negapatam	29·863	—·016	+·038	82·0	76	89·5	77·2	S.-W.	2	5	*Nil*	
8		Madras	29·854	—·025	+·043	80·0	82	90·5	75·0	S.-S.-W.	3	4	*Nil*	
8		Cocanada	29·773	—·016	?	82·5	71	91·0	81·6	W.-S.-W.	10	10	*Nil*	Sea smooth.
8		Vizagapatam	29·805	+·010	+·081	85·0	68	90·3	82·6	S.-W.	2	8	*Nil*	
8		Gopalpur	29·717	+·001	+·063	82·5	91	87·2	79·8	S.-W.	20	6	0·58	Sea slight.
8		False Point	29·086	—·023	+·020	82·3	91	89·5	79·2	W.-S.-W.	14	10	0·74	
8		Balasore	29·665	—·012	?	80·5	89	88·4	78·7	S.	8	?	*Nil*	
8		Saugor Island	29·663	0	+·001	81·9	85	85·2	81·0	S.-W.	20	10	0·04	
8	East Coast Bay	Chittagong	29·670	—·044	—·043	77·7	96	82·6	76·0	S.-W.	4	8	4·73	
8		Akyab	29·734	—·032	+·006	77·0	95	83·2	79·6	S.-S.-W.	8	10	1·78	
8		Diamond Island	29·866	+·008	+·037	81·4	89	86·4	73·5	S.-W.	10	6	0·15	
8		Rangoon	29·867	—·002	+·012	75·2	95	86·1	75·4	W.-S.-W.	22	10	0·95	
8 8		Tavoy	29·879	—·001	?	77·0	92	81·7	73·7	S.-W.	4	10	1·23	
10	Mid Bay	Port Blair	29·947	—·061	+·071	77·7	93	88·0	75·4	S.-S.-W.	6	10	0·95	Overcast drizzling.
10		Nancowry	29·932	+·017	+·025	85·0	75	87·6	75·0	S.-W.	6	8	*Nil*	
A.M.	B. Sea Observations. Lat. N. . Long E.	Stations or Vessels.												
10	21°-02′ . 88°-46′	Mutla Light	29·661	—·024	—·029	83·3	94	...	...	W.-S.-W.	6*f*	10	Amounts of rainfall not recorded.	Continuous rain.
10	21°-26′ . 88°-6′	Lower Gaspar	29·630	+·091	—·040	83·9	87	...	...	W. S.-W.	5*f*	8		Squally and raining.
10	21°-14′ . 88°-11′	Intermediate	29·653	—·040	—·027	83·5	87	...	...	S.-W.	4*f*	10		Sea slight.
10	20°-46′ . 87°-39′	Ridge Light	29·721	—·009	+·026	83·8	89	...	...	S.-W.	4*f*	2		Heavy swell.
A.M. 8	17°-11′ . 84°-35′	S. S. *Medea*	29·764	+·031	+·034	84·2	92	86·7	82·4	S.-W. by W.	4*f*	8		Cloudy.
8	9°-43′ . 85°-37′	S. S. *Colaba*	29·872	—·005	+·012	...	...	...	...	W.-S.-W.	2*f*	...		Sea smooth, fine weather.
8	15°-07′ . 82°-10′	S. S. *Nurjehan*	29·819	+·058	+·049	...	...	...	...	S.-W. by S.	4*f*	...		Fine.

* In the column for velocity of wind, numbers marked *f* represent wind force on Beaufort's scale 0-12.

15th August 1888—continued.

Hour.	Position of Stations.	STATIONS.	BAROMETER.			Temperature.	Humidity.	TEMPERATURE PREVIOUS 24 HOURS.		WIND.		Cloud proportion.	Rainfall.	WEATHER REMARKS.
			Actual reduced to 32° and sea level.	Change since previous 24 hours.	Variation from normal.			Maximum.	Minimum.	Direction.	Velocity. Miles per hour.			
A.M.	C. INLAND STATIONS.													
10	Assam .	Sibsagar .	29·655	−·020	−·049	84·7	85	91·1	79·1	S.-W.	2	10	0·09	
10		Silchar .	29·663	−·015	−·043	84·7	82	88·5	77·2	N.-E.	2	8	0·25	
10		Dhubri .	29·627	−·008	−·060	85·7	82	88·2	78·8	Calm	3	3	*Nil.*	
10	East Bengal .	Furreedpore .	29·660	+·002	+·006	80·1	91	84·5	78·4	S.-W.	3	10	0·73	
10		Dacca .	29·639	−·009	−·003	79·5	95	85·6	78·7	S.-W.	4	10	0·97	
10		Burrisal .	29·666	−·014	+·007	81·2	89	81·3	76·4	W.-S.-W.	5	10	2·34	
10		Mymensingh .	29·632	−·006	−·022	86·2	82	86·4	78·0	S.-E.	3	8	0·12	
10		Commilla .	29·648	−·014	+·005	78·7	99	83·4	76·7	S.	4	9	0·31	
10	North Bengal .	Maldah .	29·590	−·006	?	83·2	88	89·6	76·9	S.-E.	3	8	1·94	
10		Bogra .	29·600	−·001	?	81·1	92	87·3	77·8	Calm.	2	10	0·34	
10		Serajgunj .	29·614	−·006	−·035	84·0	83	85·2	78·8	W.-S.-W.	2	10	0·39	
10		Rampore Bauleah .	29·624	+·007	−·004	80·6	86	85·2	77·4	S.-W.	7	8	1·30	
10		Dinagepore .	29·594	−·013	−·030	87·2	80	91·6	80·6	E.-S.-E.	4	8	0·66	
10		Rungpore .	29·617	−·015	−·064	81·7	79	90·8	78·7	S.-S.-E.	6	2	*Nil.*	
10		Jalpaiguri .	29·618	+·001	−·049	83·0	90	90·0	78·9	S.-E.	4	4	2·00	
10	S.-W. Bengal.	Jessore .	29·646	−·007	+·008	80·0	97	86·7	77·9	S.-S.-E.	2	10	1·71	
10		Calcutta .	29·655	−·006	+·012	81·4	91	86·0	75·7	S.-W.	6	10	3·86	
10		Kishnaghur .	29·666	+·010	−·003	80·7	91	87·3	76·8	W.-S.-W.	5	10	5·93	
10		Burdwan .	29·640	+·002	+·006	81·4	87	90·6	77·4	S.-W.	3	10	0·70	
10		Raneegunge .	29·639	+·025	+·030	76·4	96	88·0	76·8	S.-W.	4	10	2·30	
10		Berhampore .	29·622	0	−·012	77·3	95	86·6	75·8	S.-S.-W.	8	10	4·00	
10	Behar .	Bhagalpur .	29·587	−·030	−·033	82·8	91	88·4	81·0	N.-W.	3	7	0·23	
10		Nya Doomka	29·603	−·015	?	76·0	95	86·5	75·8	Calm	3	10	7·54	
10		Durbhunga .	29·606	0	−·003	87·0	76	88·9	81·3	W.-N.-W.	3	9	*Nil.*	
10		Patna .	29·621	−·006	+·002	84·6	79	91·9	80·7	W.	2	10	*Nil*	
10		Gya .	29·615	−·008	−·007	84·2	72	89·9	76·8	N.-W.	4	10	*Nil.*	
10		Buxar .	29·619	−·019	+·012	82·0	83	88·4	78·7	N.-W.	7	10	*Nil.*	
10	Chutiar Nagpu	Hazaribagh .	29·669	−·002	+·027	75·5	90	83·4	73·1	W.-N.-W.	9	10	0·12	
10		Ranchee .	29·681	+·028	+·027	72·7	86	85·0	72·9	S.-W.	6	10	0·18	
10	N.-W. Provinces.	Benares .	29·616	−·012	−·010	81·5	85	87·3	79·0	S.-W.	5	10	0·07	Gloomy.
10		Allahabad .	29·614	−·003	−·017	81·9	84	83·4	76·6	W.-S.-W.	9	10	0·04	Do.
10		Lucknow .	29·607	−·006	−·031	84·6	81	88·3	78·8	N.-N.-W.	1	10	*Nil.*	
10	Central Provinces.	Jubbulpore .	29·706	−·003	+·037	81·1	75	83·7	73·6	W.-S.-W.	4	2	*Nil.*	
10		Raipur .	?	?	?	83·5	70	86·2	76·0	W.-S.-W.	9	9	0·04	
10		Nagpur .	29·727	−·013	−·031	84·2	74	88·9	75·5	S.-W.	12	7	0·07	

On this day, over the whole Bay and at the coast stations, normal south-west monsoon weather obtained. Winds were south-westerly in almost all cases, and were also fairly strong. The differences of pressure between the entrance and head of the Bay were equal to almost three-tenths of an inch, which is about normal for the season. Rather heavy rain, slightly squally weather, and moderate swell were reported at the light-ships at the head of the Bay. At the coast stations round the northern half of the Bay, moderate to heavy rain was falling, the rainfall being decidedly heavy at Chittagong. Over the southern half of the province of Bengal, winds were also south-westerly except at the south-eastern stations where southerly and south-easterly winds were blowing. In Behar, westerly and north-westerly winds were reported, while, in some parts of North Bengal, as at Dinagepore, an easterly wind was blowing. Pressure was falling moderately to rapidly over parts of North Bengal, and the lowest pressure registered in the province was 29·587″ at Bhagalpur, where wind was north-west, and the next lowest was 29·590″ at Maldah, where the wind was south-east, while to the south, south-west and east of these stations, pressure increased rapidly; and to the west pressure was also higher, but not to so large an extent. It is therefore clear that a barometric depression was forming over the area between the two stations above named. General rain was being received over the whole province, most districts receiving average falls of half an inch and upwards. Very heavy rain was falling over the central districts of South-West and East Bengal, that is, to the south and south-west of the position in which the depression had formed, as is shown in the following table :—

RAINFALL FOR THE TWENTY-FOUR HOURS ENDING 6 P.M.
15th August 1888.

Meteorological Division.	Average Rainfall.	Heavy Rainfalls exceeding 3 inches.		
		District.	Stations.	Amount.
	Inch.			Inches.
ORISSA . . .	0·45	... ..	......	...
S.-W. BENGAL .	2·49	24-Pergunnahs .	Canning Town . .	4·00
			Alipore Jail . .	5·15
			Barrackpore . .	3·83
			Buseerhat . . .	3·49
		Howrah . .	Howrah . . .	3·75
			Mohesreka . . .	5·50
		Hooghly . . .	Hooghly . . .	3·09
		Burdwan . .	Culna . . .	3·59
			Raneegunge . .	3·74
		Beerbhoom . .	Soory . . .	5·64
			Ramporehaut . .	9·88
			Bolpur . . .	3·51
			Murarai . . .	4·45
		Nuddea . .	Chooadanga . .	5·60
			Meherpore . . .	6·30
		Moorshedabad .	Berhampore . . .	3·90
			Lalbagh . . .	4·68
			Azimgunge . . .	3·24
			Jungipore . . .	5·04
			Lalgola . . .	7·52
EAST BENGAL . .	1·25	Chittagong . .	Cox's Bazaar . .	3·43
			Chittagong . . .	4·55
			Satkanya . . .	6·05
		Chittagong Hill Tracts.	Rangamati . . .	3·58
			Ruma . . .	4·25
		Tipperah . . .	Kasba . . .	3·62
NORTH BENGAL .	0·50	......	......	...
NORTH BEHAR . .	0·16	......	......	...
SOUTH BEHAR . .	0·66	Sonthal Pergunnahs .	Nya Doomka . .	6·07
			Jamtara . . .	3·05
CHUTIA NAGPUR .	0·87	......	......	...

Falls in excess of 3 inches were therefore numerous, while no less than ten stations reported amounts exceeding 5 inches, and at Ramporehaut nearly 10 inches had fallen.

The meteorological conditions in Bengal therefore on this day were to a considerable extent dependent on the existence of the depression between Maldah and Bhagalpur. A fairly strong and very moist current was feeding it from the south and south-east, and was giving very heavy rain to the central districts of Bengal.

16th August 1888.—The meteorological conditions of the Bay of Bengal, and over the land area to the north of it, on the 16th of August can be seen by the observations in the following table, which is, as before, divided into three sections dealing with the coast-area, the sea-area, and the inland-stations. The principal facts as to the distribution of pressure, the wind directions, &c., over the area dealt with are charted in Plate VII :—

16th August 1888.

Hour.	Position of Station.	STATION.	BAROMETER.			Temperature.	Humidity.	TEMPERATURE PREVIOUS 24 HOURS.		WIND.		Cloud proportion.	Rainfall.	WEATHER REMARKS.
			Actual reduced to 32° and sea level.	Change since previous 24 hours.	Variation from normal.			Maximum.	Minimum.	Direction.	Velocity. Miles per hour.			
	A. COAST STATIONS.													
A.M. 9-30	Ceylon	Galle	29·974	+·004	?	81·0	91	82·0	78 0	N.-W.	4	2	*Nil.*	
9-30		Colombo	29·973	+·022	+·039	81·5	79	84·0	75·0	S.-S. W.	10	6	0·09	
9-30		Trincomalee	29·891	+·016	?	85·5	65	99 5	77·0	S.-W.	12	3	*Nil.*	
8	West Coast Bay.	Negapatam	29·883	+·020	+·057	81·9	74	90·0	78·2	W.	4	6	0·02	
8		Madras	29·884	+·030	+·060	79·5	82	87·0	74·5	S -W.	3	9	0·02	
8		Cocanada	29·793	+·020	?	78·5	74	92·0	77·6	W.-S.-W.	12	10	2·45	Sea smooth.
8		Vizagapatam	29·758	−·047	+·072	83·5	64	88·3	82·1	S.-W.	4	10	*Nil.*	
8		Gopalpur	29·663	−·054	+·024	81·5	87	85·2	78·8	S -W.	22	2	0·36	Sea smooth.
8		False Point	29·634	−·052	−·005	80·3	89	86·4	75·6	W.-S.-W.	18	9	0·24	
8		Balasore	29·599	−·066	?	79·5	89	87·4	77·7	S.-W.	10	8	0·12	
8		Saugor Island	29·583	−·080	−·039	81·5	83	85·7	79·5	W.-S.-W.	30	10	0 23	Sea rough.
8	East Coast Bay	Chittagong	29·662	−·008	−·035	76·1	96	78·1	75·0	S.-S.-E.	4	9	2·37	
8		Akyab	29 732	−·002	+·020	76·0	95	80·2	77 6	N.-W.	6	10	5·50	
8		Diamond Island.	29·832	−·034	+·044	80·4	91	84·9	76·0	S -W.	8	9	0·23	
8		Rangoon	29·870	+·003	+·046	74·2	95	84·1	73·9	W.-S.-W.	10	10	1·46	
8		Tavoy	29·913	+·023	?	74·8	95	81·5	72·2	S.-W.	3	10	2·94	
A.M. 10	Mid Bay	Port Blair	29·905	−·042	+·048	84·7	79	86·0	75·4	S.-W.	5	6	*Nil.*	Cloudy.
10		Nancowry	29·934	+·002	+·028	84·8	83	86·0	75·6	S.-W.	3	10	0·20	Overcast.

16th August 1888—continued.

Hour.	Position of Station.		Station or Vessel.	Barometer.			Temperature.	Humidity.	Temperature previous 24 hours.		Wind.		Cloud proportion.	Rainfall.	Weather Remarks.
				Actual reduced to 32° and sea level.	Change since previous 24 hours.	Variation from normal.			Maximum.	Minimum.	Direction.	Velocity, Miles per hour.			
	B. Sea Observations.														
A.M	Lat.N.	Long.E.										*			
10	21°-02′	88°-46′	Mutla Light.	29·612	—·049	—·078	82·3	89	...	...	W.-S.-W.	7f	10	Amounts of rainfall not recorded.	Strong wind.
10	21°-26′	88°-6′	Lower Gasper	29·565	—·065	—·105	82·9	83	...	...	S.-W.	4f	10		Rainy.
10	21°-14′	88°-11′	Intermediate	29·597	—·056	—·083	83·5	79	...	..	S.-W.	6f	8		Sea rough.
10	20°-46′	87°-39′	Ridge Light.	29·673	—·048	—·022	83·3	85	...	...	S.-W.	5f	2		Heavy swell.
8			P. V. *Sarsuti*	29·606	...	—·089	...		...		W.-S.-W.	5 to 6f.	..		Cloudy.
8			P. V. *Coleroon*	29·594	...	—·101	..		...	...	S.-W. by W.	4f	.		Overcast.
noon	6°-56′	82°-03′	S. S. *Rohilla.*	29·894	?	+·044	..		...	...	S.-S.-W.	3 to 4f	.		Light wind.
A M 8	11°-44′	95°-11′	S S *Tawang*	29·925	0	+·055	...	.	..	...	W.-S.-W.	5f	.		Cloudy.
8	11°-00′	80°-53′	S. S. *Clan Macpherson.*	29·876	—·007	+·046	...		...	...	W.-S.-W.	6f	...		
8	14°-42′	82°-13′	S. S *Medea.*	29·808	?	+·038	81·1	84	86·7	82·4	W. by S.	4f			
8	12°-31′	84°-52′	S. *Colaba*	29·862	—·005	+·032	...		...	..	W.	2f			Fine weather.
	C. Inland Stations.														
A.M.															
10	Assam		Sibsagar	29·682	+·027	—·009	79·1	95	91·6	78·0	N.-E.	4	10	0·14	
10			Silchar	29·662	—·001	—·039	80·1	91	88·5	76·7	E.-N.-E.	3	10	0·71	
10			Dhubri	29·603	—·024	—·066	82·6	86	87·2	78·3	E.-S.-E.	3	9	0·35	
10	East Bengal		Dacca	29·594	—·045	—·042	77·5	95	84·1	77·7	S.-W.	4	10	0·57	
10			Jessore	29·596	—·050	—·038	79·5	94	87·7	77·4	W.-S.-W.	2	10	0·75	
10			Calcutta	29·594	—·061	—·036	78·9	91	84·5	75·2	S.-W.	7	10	1·85	
10			Kishnaghur	29·602	—·064	—·042	77·7	95	83·9	76·3	W.-S.-W.	6	10	0·53	
10	North Bengal		Julpaiguri	29·596	—·022	—·061	82·5	90	90·5	76·8	N.-E.	3	4	0·80	
10			Serajgunj	29·567	—·047	—·069	81·5	91	87·1	79·8	E.	?	9	0·01	
10			Rampore Beauleah.	29·577	—·047	—·033	82·6	86	85·8	78·5	S.-E.	5	5	*Nil.*	
10	S.-W. Bengal		Berhampore	29·570	—·052	—·057	82·3	87	84·1	77·8	S.-S.-E.	6	10	0·08	
10			Burdwan	29·573	—·067	—·052	77·9	91	84·5	76·4	Calm.	3	10	0·52	
10			Raneegunge	29·550	—·089	—·036	79·4	97	79·5	75·4	S.-W.	4	10	2·25	
10			Purneah	29·580	—·035	—·036	87·6	80	91·7	76·6	E.	2	5	0·47	
10	Behar		Nya Doomka	29·572	—·031	?	82·7	83	84·3	74·8	E.	1	10	0·11	
10			Bhagalpur	29·566	—·021	—·038	85·8	81	86·4	79·0	E.	2	5	0·42	
10			Durbhunga	29·579	—·027	—·014	87·0	78	89·4	82·3	N.-E.	5	8	0·12	
10			Patna	29·590	—·031	—·020	84·6	87	86·4	79·7	W.-S.-W.	2	10	0·02	
10			Gya	29·572	—·043	—·044	82·1	76	87·9	74·3	W.	2	10	1·67	
10			Dehree	29·597	—·028	—·017	83·4	89	86·8	74·0	W.	6	8	0·17	
10			Buxar	29·605	+·014	+·008	86·0	83	86·4	79·7	N.-W.	6	8	*Nil.*	
10	Chutia Nagpur		Ranchee	29·609	—·072	—·024	71·2	93	76·5	69·9	N.-N.-W.	4	10	4·85	
10			Hazaribagh	29·613	—·056	—·037	71·1	97	76·4	70·2	W.	9	10	1·05	
10	N.-W. Provinces.		Benares	29·595	—·020	—·018	84·4	85	86·8	79·9	W.	5	9	0·02	Gloomy.
10			Allahabad	29·610	—·003	—·002	83·1	87	84·3	79·5	N.-N.-W.	7	10	*Nil.*	Overcast.
10			Lucknow	29·618	+·012	—·003	86·6	78	93·3	80·8	E.-S.-E.	6	8	*Nil.*	
10	Central Provinces.		Jubbulpore	29·713	+·004	+·037	80·0	76	87·2	73·9	W.	7	9	*Nil.*	
10			Raipur	?	?	?	81·7	77	84·1	75·8	W.-S.-W.	10	10	*Nil.*	Overcast.
10			Nagpur	29·725	—·001	+·037	85·5	65	90·8	76·5	W.-S.-W.	13	7	*Nil.*	*

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* In the column for velocity of wind, numbers marked "*f*" represent wind force on Beaufort's scale 0-12.

In the centre and south of the Bay pressure was generally fairly steady; at some of the western stations it was rising, and at some of the eastern stations falling slowly. At the head of the Bay pressure was falling rapidly, particularly at the western stations, and at Saugor Island a fall of 0·08 inch was reported, and on this day the pressure at Saugor Island again became lower than it was at most of the other stations in its neighbourhood, instead of being somewhat higher than at such stations as Calcutta, Jessore, Kishnaghur, &c, as is normally the case. This probably indicates the continued existence of the low pressure in that district, which had been a prominent feature in the meteorology of Bengal for the previous six weeks. The differences of pressure over the Bay had, if any thing, rather increased, and strong south-westerly winds continued to be reported over the whole Bay. At the Sandheads rough sea with heavy swell, rain and strong winds were reported. General rain was falling at the coast stations, particularly on the east coast of the Bay, Akyab having received five and a half inches, and Chittagong two and a half inches, in the previous 24 hours.

In Bengal, the small depression, which was on the 15th between Maldah and Bhagalpur, had moved about 90 miles in a west-south-westerly direction, and its centre was, on this day, a little distance to the south-west of Bhagalpur, or between that station and Raneegunge. The depression at its centre was still small in amount, and no station reported a pressure lower than 29·55 inches. A well-marked cyclonic circulation of winds which extended over the whole of Bengal and Behar accompanied the small storm, but the wind-force was moderate.

As on the previous day rain was general over the whole province of Bengal, and the various districts received average falls of from about four-tenths of an inch in North Bengal and North Behar to nearly 3 inches in Chutia Nagpur. As on the 15th the heaviest falls did not occur near the centre of the depression, but on the southern side of it. In the Midnapore and 24-Pergunnahs districts of South Bengal, and some of the districts of Chutia Nagpur, very heavy falls occurred, as are shown in the accompanying table.

RAINFALL FOR THE TWENTY-FOUR HOURS ENDING 6 P.M.

16th August 1888.

Meteorological Division.	Average Rainfall.	HEAVY RAINFALLS EXCEEDING 3 INCHES		
		District.	Station.	Amount.
	Inch.			Inches
ORISSA . . .	0·66	......	......	...
SOUTH-WEST BENGAL.	0·94	Midnapore . .	Tumlook . . .	3·50
			Kukrahaty . . .	4·82
			Bhagwanpore . .	3·99
		24-Pergunnahs .	Diamond Harbour .	3·27
			Canning Town . .	4·10
EAST BENGAL . .	1·29	Chittagong . .	Cox's Bazaar . .	3·95
		Backergunge . .	Patuakhally . .	5·67
		Noakholly . . .	Harrishpore . .	4·12
		Tipperah . . .	Commilla . . .	5·26

16th August 1888—continued.

Meteorological Division.	Average Rainfall.	Heavy Rainfalls exceeding 3 inches.		
		District.	Station.	Amount.
	Inch.			Inches.
North Bengal . .	0·40	......	......	...
„ Behar . .	0·38	......	......	...
South Behar . .	0·83	Sonthal Pergunnahs .	Godah . . .	3·50
Chutia Nagpur .	2·72	Hazaribagh . .	Semtagurah . .	3·98
			Mahudi Hills . .	4·37
			Jhoomrah Hills . .	5·50
			Ramghar . . .	3·50
		Lohardugga . .	Lohardugga . . .	3·25
			Ranchi	4·60
			Palamow . . .	4·73
			Silli	10·00
			Garwah . .	3·50
		Singbhoom . .	Chyebassa . . .	3·60

The rainfall on this day was perhaps not quite so heavy as on the previous day, and the falls in excess of 5 inches were not very numerous. Only one station, Silli, in the Lohardugga district, received a fall of 10 inches.

The principal features in this day's meteorology were therefore the west-south-westerly movement of the depression in the centre of the province, and the renewed tendency to the development of the low pressure area in the south-west of the province near Saugor Island Except for these two features, almost normal monsoon weather obtained both in the Bay of Bengal and also in Bengal, Behar, and the neighbouring districts of the North-Western and Central Provinces.

17th August 1888.—The meteorological observations taken on the morning of this date are contained in the following table, which is divided into three sections as on previous days. The principal facts as to the barometric pressures and wind directions on this day are given in Plate VIII.

17th August 1888.

Hour.	Position of Station.	Station or Vessel.	Barometer. Actual reduced to 32° and sea level.	Barometer. Change since previous 24 hours.	Barometer. Variation from normal.	Temperature.	Humidity.	Temperature previous 24 hours. Maximum.	Temperature previous 24 hours. Minimum.	Wind. Direction.	Wind. Velocity. Miles per hour.*	Cloud proportion.	Rainfall.	Weather Remarks.
A.M	**A. Coast Stations.**													
9-30	Ceylon	Galle	29·988	+·014	?	81·5	89	82·5	78·5	N.-W.	4	2	*Nil.*	
9-30		Colombo	29·986	+·013	+·049	82·5	75	84·5	76·5	S.-S.-W.	10	7	*Nil.*	
9-30		Trincomalee	29·911	+·020	?	85·5	66	98·5	77·0	S.-W.	10	3	*Nil.*	
8	West Coast Bay.	Negapatam	29·877	−·006	+·049	83·4	73	90·0	79·3	W.	6	8	*Nil.*	
8		Madras	29·870	−·014	+·048	83·0	77	87·0	78·5	W.-S.-W.	7	9	*Nil.*	
8		Cocanada	29·735	−·058	?	78·5	87	87·5	77·6	W.	10	10	0·26	Sea smooth.
8		Vizagapatam	29·700	−·058	+·039	84·0	68	88·8	80·6	S.-W.	2	4	*Nil*	
8		Gopalpur	29·629	−·034	+·007	81·0	85	85·2	79·8	S.	12	7	*Nil.*	Sea smooth.
8		False Point	29·620	−·014	−·019	80·3	87	88·5	75·1	W.-S.-W.	22	10	0·28	
8		Balasore	29·577	−·022	?	78·5	85	87·4	76·7	S.-W.	12	7	*Nil.*	
8		Saugor Island	29·550	−·033	−·061	82·4	83	89·2	81·5	S.-W.	38	10	*Nil.*	Sea rough.
8	East Coast Bay	Chittagong	29·709	+·047	+·011	75·6	96	83·6	73·0	S.-S.-E.	4	10	0·87	
8		Akyab	29·729	−·003	+·020	80·1	96	80·2	78·6	S.-W.	2	10	1·06	
8		Diamond Island	29·842	+·010	+·043	81·4	89	82·4	73·5	S.-W.	8	5	0·15	
8		Rangoon	29·896	+·026	+·052	73·2	98	83·1	73·4	N.-N.-W.	?	10	2·36	
8		Tavoy	29·902	−·011	?	74·9	95	79·8	71·9	Calm.	3	10	3·18	Rainy.
10	Mid Bay	Port Blair	29·898	−·007	+·037	83·9	84	87·0	79·9	S.-W.	10	5	*Nil.*	Misty.
10		Nancowry	29·916	−·018	+·008	87·2	79	90·4	70·0	S.-W.	3	7	*Nil.*	
	B. Sea Observations.													
A.M.	Lat N. Long.E.													
10	21°-02′ 88°-46′	Mutla Light	29·602	−·010	−·088	82·3	91		...	S.-W.	8*f*	10	Amounts of rainfall not recorded.*	Squally, rainy.
10	21°-26′ 88°-6′	Lower Gasper	29·512	−·053	−·068	82·9	83	...	...	S.-W.	5*f*	10		Do. do
10	21°-14′ 88°-11′	Intermediate	29·557	−·040	−·123	81·7	92	...	.	W.-S.-W.	5*f*	9		Sea very rough.
10	20°-46′ 87°-39′	Ridge Light	29·615	−·058	−·065	82·8	83	...	...	W.	6*f*	2		Confused sea.
8		P. V. *Sarsuti*	29·570	−·040	−·110	...	..	..	...	S.-W.	6-7*f*	.		Overcast.
8		P. V. *Coleroon*	29·580	−·010	−·100	...		...		S.-W.	5*f*	..		Overcast and squally.
8	11°-11′ 84°-0′	S. S. *Rohilla*	29·899	?	+·059	...		.	...	S.-Wly.	3-4*f*			Moderate wind, fine.
8	15°-12′ 92°-40′	S.S. *Taisang*	29·885	?	+·075	.		...	...	W. by S.	4*f*	.		Overcast.
8	7°-45′ 91°-08′	S.S *Bancoora*	29·899	?	−·001	.	..	...	..	S.-W.	4*f*			Moderate, south-westerly swell.
8	21°-21′ 91°-6′	S. S. *Kapurthala.*	29·643	+·024	−·072	...		...	...	S. by W.	4*f*	..		Overcast.
8	At Madras	S. S. *Medea*	29·846	?	+·046	81·9	90	86·0	80·6	S.-W.	3*f*	9		Cloudy.
8	9°-35′ 83°-15′	S. S. *Lalpoora*	29·894	−·075	+·049	...	.	...	...	S.-Wly	3*f*	.		Sea smooth.
8	15°-35′ 86°-00′	S. S. *Colaba*	29·867	+·010	+·102	...	.	...	...	S.-W.	4*f*			Fine.

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* In the column for velocity of wind, numbers marked "*f*" represent force on Beaufort's scale 0-12.

19th August, 1888—continued.

Hours	Position of Station.	Station or Vessel.	Barometer.			Temperature.	Humidity.	Temperature previous 24 hours.		Wind.		Cloud proportion.	Rainfall.	Weather Remarks.
			Actual reduced to 32° and sea level.	Change since previous 24 hours.	Variation from normal.			Maximum.	Minimum.	Direction.	Velocity. Miles per hour.			
A.M.	C. INLAND STATIONS.													
10	Assam	Sibsagar	29·711	+·029	+·023	84·2	82	87·6	78·0	N.-N.-E.	2	10	*Nil.*	
10		Silchar	29·705	+·043	–·004	84·7	75	87·5	75·3	N.-N.-E.	2	9	0·19	
10		Dhubri	29·651	+ 048	–·021	84 6	77	85·2	78 3	E.	9	5	0·29	
10	East Bengal	Dacca	29·614	+ 020	– 030	78·5	95	83·6	77·2	E.-S. E.	9	10	0·24	
10	North Bengal	Julpaiguri	29·635	+ 039	–·022	83·0	86	86·9	76·8	E.-N.-E.	3	2	0·60	
10		Serajgunj	29·597	+·030	–·040	81 5	85	84·7	76·7	E.	7	9	0·21	
10		Rampore Beauleah	29·581	+·004	–·037	81·6	88	84·8	77·6	S.-E.	5	6	0·80	
10	S.-W. Bengal	Jessore	29·584	– 012	– 059	81·0	88	84·7	77·4	S.	4	10	0·87	
10		Calcutta	29 572	–·022	–·062	78·0	89	84·0	77·2	S.-W.	7	10	0·21	
10		Kishnaghur	29·586	–·016	–·050	80·2	87	82·9	76·3	S.-S.-W.	6	10	3·24	
10		Burdwan	29·546	–·027	–·080	78 4	89	86·5	76·9	S.	3	10	1·00	
10		Berhampore	29 564	– 006	–·071	82·3	87	85·1	7·73	S.-E.	5	10	0·92	
10		Midnapore	29·593	– 025	– 040	81·5	87	87·3	76·3	S.	4	4	0·54	
10	Behar	Raneegunge	29 5 4	–·036	– 072	79·4	92	88·0	76 8	E.-S.-E.	3	10	0·36	
10		Purneah	29·601	+ 021	–·009	83 6	83	90·2	74·6	E.-S.-E.	3	6	*Nil.*	
10		Naya Doomka	29·535	–·031	?	82 2	86	87·6	76·3	E.	11	10	0·75	
10		Bhagalpur	29 564	– 002	–·043	83·3	81	90·2	78 0	E.	7	6	0·08	
10		Durbhunga	29·604	+·025	+ 009	84·5	76	89·9	78·8	E.-N.-E.	8	8	0·15	
10		Patna	29·567	–·023	–·050	82·1	83	85·4	79·2	E.	3	10	1·02	
10		Gya	29·522	– 075	–·095	82·1	79	84 4	76·8	N.-N.-E.	3	10	6·33	
10		Dehree	29·548	–·049	–·072	79·4	91	85·3	76·0	E.-S.-E.	11	10	3·08	
10		Buxar	29·538	–·067	–·061	81·5	95	91·9	76·7	E.-N.-E.	9	9	1·03	
10	Chota Nagpur.	Chybassa	29·547	–·020	?	78·3	82	81·5	74·7	S.-W.	2	10	0·90	Overcast.
10		Ranchee	29·544	–·065	–·077	72·2	90	77·5	69·4	W.-S.-W.	6	10	1·79	
10		Hazaribagh	29·540	–·093	–·101	73·1	98	77·4	69·7	W.	8	10	7·70	
10	N.-W. Provinces.	Benares	29·579	– 019	–·038	78·8	95	86·0	76·6	N.-E.	5	10	3·44	Gloomy.
10		Allahabad	29·606	–·006	–·015	79·4	94	89·7	74·6	N.-N.-W.	5	10	1·42	Do.
10		Lucknow	29·662	+ 038	+·025	78·7	91	91·3	75·8	S.-S.-W.	4	10	0·63	Rainy.
10	Central Provinces.	Jubbulpore	29·695	– 030	+·007	75·8	94	86·1	73·4	W.-S.-W.	5	10	0·17	Overcast.
10		Raipur	?	?	?	76 6	83	84·2	72·7	W.-S.-W.	20	10	1·88	Do.
10		Nagpur	29·741	0	+·035	76·4	93	90·4	75·1	W.	14	10	0·09	Do.

In the first and second sections are given the data which refer to the Bay. In that area pressure was generally rising slowly at the south-western stations, while it was falling at the south-eastern stations and moderate south-westerly winds and generally fine weather prevailed over the whole area. At the eastern stations in the northern half of the Bay pressure was generally rising, but at the western stations, and particularly at Saugor Island, a considerable fall of pressure was reported, showing that the area of comparatively low pressure near this station was slowly increasing in intensity. This fact is also supported by the readings taken on board the Lower Gasper and Intermediate light-ships, and also by the facts that while at Saugor Island the barometer was 29·550 inches, at Balasore it was 29·577 inches, at Calcutta 29·572 inches, at Kishnaghur 29·586 inches, and at Jessore 29·584 inches, while, as stated in the discussion of the previous day, pressure should under normal weather conditions in August be higher at Saugor Island than at these stations. Winds over the northern half of the Bay were usually south-westerly though at the eastern stations they were becoming southerly and south-easterly. Winds at the coast stations were only moderate in strength, and rainfall was either light, or in many cases entirely absent; but on the light-ships at the Sandheads and on the Pilot vessels squally rainy weather with very rough confused sea obtained. On this day, however, at the head of the Bay there was absolutely no tendency to anything like cyclonic circulation of winds, and steady-south-westerly and southerly winds were reported in every instance.

The observations at the inland stations in Bengal, and Behar show that the small storm which was on the 16th to the south-west of Bhagalpur had again slowly drifted westward, and its centre was a little more than 100 miles to the west of its previous position, and not far from Gya, where the barometer was 29·522 inches, and where a north-north-easterly wind was reported. In all probability, the centre was between Gya and Hazaribagh, as at the latter station a pressure of 29·540 inches and a west wind were reported. The depression had therefore deepened slightly during the 24 hours from the 16th to the 17th, though it was still slight. The small storm continued to be accompanied by a definite cyclonic circulation of winds, which practically extended over the whole province of Bengal. Light to moderate winds were reported, except at the coast stations in the north-west angle of the Bay.

On this day rainfall was light in Orissa and in North Bengal, and moderate in South-West Bengal, North Behar, and East Bengal, all of which districts were outside the area covered by the small storm. South Behar, in which the storm was travelling, and Chutia Nagpur to the south of it, both reported very heavy rain, averaging nearly two inches, while in some districts, as shown in the following table, falls of three inches and upwards were rather numerous :—

RAINFALL FOR THE TWENTY-FOUR HOURS ENDING 6 P.M.
17th August 1888.

Meteorological Division.	Average Rainfall	Heavy Rainfalls exceeding 3 inches		
		District.	Station.	Amount.
	Inch.			Inches.
ORISSA	0·11	......	......	...
S.-W. BENGAL	0·53	Nuddea	Kishnaghur	3·69
EAST BENGAL	1·22	Chittagong	Cox's Bazar	3·75
			Kutubdia	6·50
		Backergunge	Patuakhally	5·18
			Bauphal	5·13
		Noakholly	Harishpore	3·25
NORTH BENGAL	0·18	......	......	...
NORTH BEHAR	0·57	......	......	...
SOUTH BEHAR	1·79	Shahabad	Dehree	4·83
			Bhuboosah	3·65
		Gya	Aurungabad	3·63
			Gya	6·09
			Jehanabad	3·46
			Arwal	3·48
			Daudnagar	4·50
			Sherrghati	6·00
		Monghyr	Sheikpura	3·12
CHUTIA NAGPUR	1·84	Hazaribagh	Hazaribagh	7·09
			Jhoomrah Hills	3·50
		Manbhoom	[illegible]	[illegible]

The principal meteorological facts on this day were therefore the continued westerly movement of the depression across Bengal and Behar at the rate of 4 or 5 miles an hour, and the further development of the feeble low pressure area in the south-west of Bengal, though up to this time the deficient pressure which existed was not accompanied by any tendency to a cyclonic circulation of winds.

18th August 1888.—The meteorological data from which the general weather of this day can be determined are contained in the three parts of the following table, and in Plate VIII are charted these data in so far as they deal with the wind directions and barometric pressures.

18th August 1888.

Hour	Position of Station.	Station or Vessel.	Barometer.			Temperature	Humidity	Temperature previous 24 hours.		Wind.		Cloud proportion	Rainfall.	Weather Remarks.
			Actual reduced to 32° and sea level	Change since previous 24 hours	Variation from normal			Maximum.	Minimum.	Direction.	Velocity. Miles per hour			
A.M.	A. Coast Stations.													
9-30	Ceylon	Galle	29·982	—·006	?	81·5	91	82·5	79·0	N.-W.	2	1	*Nil.*	
9-30		Colombo	29·981	—·005	+·052	82·5	77	84·5	77·0	S.-S.-W.	7	4	*Nil.*	
9-30		Trincomalee	29·903	—·008	?	84·0	68	96·0	77·0	S.-W.	4	6	*Nil.*	
8	West Coast Bay.	Negapatam	29·877	0	+·060	81·9	66	96·0	76·7	S.-W.	6	8	*Nil.*	
8		Madras	29·856	—·014	+·039	80·0	82	91·5	71·5	S.-W.	6	9	1·08	
8		Cocanada	29·712	—·023	?	76·5	82	85·5	76·6	W.-S.-W.	8	7	0·13	Sea smooth
8		Vizagapatam	29·667	—·033	+·004	83·0	65	90·3	80·1	S.-S.-W.	4	10	*Nil.*	
8		Gopalpur	29·607	—·022	+·004	81·0	80	85·7	79·8	W.-S.-W.	14	7	*Nil*	Sea slight.
8		False Point	29·602	—·018	—·016	82·3	85	89·5	76·1	W.	10	7	0·43	
8		Balasore	29·594	+·027	?	80·5	85	87·4	77·7	S.-W.	10	5	*Nil*	
8		Saugor Island	29·606	+·056	—·016	80·9	89	85·2	80·5	W.-S.-W.	18	9	0·04	Sea slight.
8	East Coast Bay	Chittagong	29·684	—·025	—·034	78·7	88	82·6	75·0	S.-S.-E.	4	5	0·22	
8		Akyab	29·722	—·007	—·022	76·0	95	81·2	76·1	S.	2	10	4·60	
8		Diamond Island	29·812	—·030	+·017	79·4	85	85·4	70·0	S.-W.	6	10	1·70	
8		Rangoon	29·831	—·065	+·019	75·2	93	80·6	73·9	N.-W.	?	10	0·61	
8		Tavoy	29·895	—·016	?	74·0	96	77·7	71·7	Calm	0	10	3·53	
10	Mid Bay	Port Blair	29·890	—·008	+·036	77·7	95	85·0	76·9	S.-S.-W.	10	8	1·32	Cloudy, misty.
10		Nancowry	29·906	—·010	+·007	85·4	74	89·2	76·2	S.-W.	5	9	0·05	Overcast
	B. Sea Observations.										*			
A.M.	Lat. N. / Long. E.													
10	21°-0′ / 88°-46′	Mutla Light	29·608	+·006	—·082	82·3	93		..	W.	6*f*	10	Amounts of rainfall not recorded.	Light rain.
10	21°-26 / 88°-6′	Lower Gasper	29·596	+·084	—·084	82·4	83		...	W.	2*f*	10		Slight sea.
10	21°-14′ / 88°-11′	Intermediate	29·597	+·040	—·083	8. 2	84	.	...	W.	2*f*	10		Very high south-west swell.
10	20°-46′ / 87°-39′	Ridge Light	29·636	+·021	—·044	82·8	87	.	...	S.-W.	3*f*	2		High confused sea.
8	20°-46′ / 87°-39′	P. V. *Sarsuti*	29·586	+·020	—·099	...		..	...	W. by S.	3*f*	...		Cloudy.
8		P. V. *Coleroon*	29·585	0	—·095	.		..	...	S.-W. by W.	4*f*	. .		Cloudy.
8	15°-40′ / 85°-52′	S. S. *Rohilla*	29·766	—·133	+·006	...	...	. .	...	S.-W.	4-5*f*	...		Overcast, squally.
8	18°-36′ / 90°-14′	S. S. *Taisang*	29·685	—·130	—·050	...	...	...	..	W. by S.	5*f*	...		Dull.
8	2°-40′ / 84°-35′	*Desdemona*	29·980	?	+·030	...	...	...	...	W.-S.-W.	5*f*	...		

* In the column for velocity of wind, numbers marked "*f*" represent wind force on Beaufort's scale 0-12.

18th August 1888—continued.

Hour.	Position of Station.		Station or Vessel.	Barometer.			Temperature.	Humidity.	Temperature previous 24 hours.		Wind.		Cloud proportion.	Rainfall.	Weather Remarks.
				Actual reduced to 32° and sea level.	Change since previous 24 hours.	Variation from normal.			Maximum.	Minimum.	Direction.	Velocity. Miles per hour			
A.M.	**B. Sea Observations.**														
8	9°-15′	88°-19′	S S. *Bancoora*	29·899	0	+ ·009	...	...	.	...	S.-W.	*6*f*	.	Amounts of rainfall not recorded.	
8	?	?	S. S. *Kapurthala* . .	29·698	+ ·050	?	...	...	...	...	S.-S.-E.	4*f*			
8	7°-39′	82°-08′	*First Lancashire*.	29·910	—·050	+ 050	...		...	...	W. by S.	...	...		Hazy.
8	6°-20′	78°-42′	S. S *Clan Mackay* .	29·966	+ ·010	?	...	...	. .	...	Westerly.	3*f*	.		Cloudy but fine.
8	5°-12′	85°-38′	*Toxteth* .	29·970	— 050	+ 055		..		...	S -W.	. .	...		Overcast.
8	4°-27′	81°-27′	*Sholfield* .	29·950	—·020	+ ·045	...	..		...	W.-S.-W.	5*f*	.		Slight swell from south-south-east.
8	17°-58′	87°-28	S. S. *Colaba* .	29·729	— 138	+ 019	...	.	...	..	S.-W	5*f*	..		Overcast.
8	13°-10′	84°-57′	S S. *Lalpoora*	29·835	— 059	+ ·025	...	.	...	...	S.-W.	6*f*	...		Heavy rain.
8	5°-58′	82°-56′	*Dundrennan*	29·873	—·130	—·017	...	.	.	...	W.-N.-W.	6*f*			Confused south-west swell.
A.M.	**C. Inland Stations.**														
10	Assam . .		Sibsagor .	29·717	+ ·006	+ 013	86 7	86	89·6	79·6	N.-W.	2	10	*Nil.*	
10			Silchar .	29 085	—·020	—·044	85·7	75	91·5	77·2	Calm	2	9	0·04	
10			Dhubri .	29·689	+ ·038	—·003	84·1	76	86·7	77·8	Calm	7	10	0·01	
10	East Bengal .		Dacca . .	29·651	+ ·037	— 011	81·5	87	82·6	76·7	S.-E.	8	7	1·28	
10	North Bengal .		Jalpaiguri .	29·687	+ 052	+ ·023	81 5	89	89·0	76·8	S.	3	2	*Nil.*	
10			Serajgunj .	29·648	+ ·051	—·029	85·0	83	85·7	77·2	E.	7	7	0·09	
10			Rampore Beauleah .	29·643	+ ·062	—·020	83·1	85	84·8	76·6	E.-S.-E.	6	6	1·46	
10	S.-W. Bengal .		Jessore. .	29·625	+ 041	—·033	83 4	86	84·7	78·4	S.-E.	4	10	0·16	
10			Calcutta .	29·608	+ ·036	—·050	82·4	85	84·5	78·7	S.-S.-W.	5	10	0·03	
10			Kishnaghur .	29·633	+ ·047	—·035	84·7	83	85·9	77 8	E.	6	9	0·26	
10			Burdwan .	29·605	+ ·059	—·043	82·4	83	94·1	78·4	Calm	1	10	0·27	
10			Berhampore .	29·627	+ ·063	—·029	81·3	91	84·6	77·8	E.	6	10	0·27	
10			Midnapore .	29 623	+ ·030	—·040	84·5	79	89·3	78·3	Calm	3	4	*Nil.*	
10			Raneegunge .	29·570	+ ·062	—·020	83·9	80	84·0	77·8	E.-S.-E.	3	9	0·54	
10	Behar .		Purneah .	29·659	+ ·058	+ ·027	84·6	79	87·7	74·6	E.	5	6	0·46	
10			Nya Doomka	29 606	+ ·067	?	80·7	92	85·1	75·6	E.	7	10	1·48	
10			Bhagalpur .	29·630	+ 066	—·023	79·3	93	88·7	76 0	E.	7	8	1·93	
10			Durbhunga .	29·633	+ ·029	+ ·017	82·5	85	89·4	79·3	E.-S.-E.	12	9	*Nil.*	
10			Patna . .	29·614	+ ·047	—·024	80·6	91	87·9	78·7	E.-S.-E.	10	10	0·16	
10			Gya . .	29·568	+ ·046	—·069	81·6	77	85·4	75·3	Calm	3	10	2·81	
10			Dehree. .	29·566	+ ·018	—·084	81·4	89	82·3	76·0	E.-S.-E.	13	4	2·16	
10			Buxar . .	29·577	+ ·039	—·061	79·5	91	85·4	77·7	E.	12	9	0·85	
10	Chutia Nagpur.		Chyebassa .	29·583	+ ·042	?	84·5	72	86·4	74·9	W.	2	9	*Nil.*	
10			Ranchee .	29 587	+ ·043	+ ·025	77·2	82	78·5	70·4	S.-S.-W.	2	8	0·09	
10			Hazaribagh .	29·595	+ ·055	—·053	75·5	90	76·9	71·7	S.	4	10	0·36	
10	N.-W. Provinces.		Benares .	29·553	—·023	—·054	82·1	89	82·7	77·6	E.	6	8	2·24	Gloomy.
10			Allahabad .	29·538	—·066	—·071	81·3	87	85·6	77·5	E.	11	10	1·54	Heavy showers, gloomy.
10			Lucknow .	29·596	—·060	—·032	85·6	74	85·3	78·8	S.	5	6	0·03	Drizzling.
10	Central Provinces.		Jubbulpore .	29·558	—·122	—·097	77·8	86	78·5	72·6	W.-S.-W.	4	9	0·49	Cloudy.
10			Raipur .	?	?	?	77·6	81	78·9	72·6	W.-S.-W.	15	10	0·06	Overcast.
10			Nagpur .	29·642	—·088	—·032	80·4	79	81·4	73·9	W.-S.-W.	20	10	0·06	Strong wind.
10			Nowgong .	29·523	—·162	—·111	76·7	96	79·0	73·5	N.	5	10	5·64	Gloomy.
10			Saugor .	29·563	—·031	—·088	72·7	88	79·3	71·4	S.-W.	?	10	6·44	Overcast.

* In the column for velocity of wind, numbers marked "*f*" represent wind force on Beaufort's scale 0-12.

These observations show that over the southern half of the Bay the weather conditions continued of ordinary monsoon character. The differences of pressure between the entrance and head of the Bay were fairly large. South-westerly winds of moderate force continued to blow at the coast stations and over the sea-area, and a few rain showers only were reported. In the northern half of the Bay conditions were changing. The S. S. *Colaba* in Lat. 17° 58′ N. and Long. 87° 28′ E. met with passing squalls and heavy sea, and reported a squally appearance. The S. S. *Taisang* in Lat. 18° 36′ N. and Long. 90° 14′ E. had strong squalls with heavy rain at noon, and thick and heavy rain during the greater part of the day. Southerly and south-easterly winds with heavy rain were reported from the stations on the east coast; while along the west coast in the northern half of the Bay, winds were more strongly westerly than they had been, particularly in the north-west angle of the Bay, though they were still moderate in force. Weather was however generally fine over the area where the storm afterwards developed, the only exception being at the F. L. V. *Meteor* (Lat. 20° 46′ N. and Long. 87° 39′ E.) where unsettled weather, high confused sea, and heavy southerly swell prevailed. On this day also, though pressure was falling over the whole of the centre and south of the Bay, it had increased in the north-west angle of the Bay as represented by Saugor Island, Balasore, and the Light-ships and Pilot vessels, and the low pressure which had existed near Saugor Island for the previous two days had on this day practically disappeared.

Over Bengal, Behar, and Chutia Nagpur pressure had increased rather rapidly, the increase being undoubtedly due to the continued westerly movement of the depression, which on the 17th was near Gya. In the North-Western and Central Provinces, pressure was falling very rapidly, and at Jubbulpore a fall of 0·122 inch was reported, and at Nowgong one of 0·162 inch. At 8 A. M. of this day the centre of the depression was between Sutna and Nowgong The storm had therefore travelled about 250 to 300 miles in a due westerly direction since the previous day, and its velocity had increased considerably, for while the mean movement from the 16th to the 17th was about 4 or 5 miles an hour, from the 17th to the 18th it was about 11 or 12 miles an hour. The depression was slightly deeper than it had previously been. A well-marked cyclonic circulation of winds continued to accompany the storm. In the province of Bengal, the cyclonic circulation had almost ceased, and at the majority of the stations winds showed indraught only towards the storm-area. At some of the stations, however, in Chutia Nagpur, winds were southerly and south-westerly, and apparently formed part of the circulation, but in all other cases easterly and south-easterly winds were blowing.

Except in the extreme west of Behar and Chutia Nagpur which were still somewhat influenced by the storm, rainfall had become rather light and local over the whole of the province of Bengal, and the average falls in the various districts were from about a fifth to four-fifths of an inch as are shown in the following table:—

RAINFALL FOR THE TWENTY-FOUR HOURS ENDING 6 P.M.

18th August 1888.

DISTRICTS.	Average Rainfall.
	Inch.
Orissa	0·24
South-West Bengal. . . .	0·33
East Bengal	0·30
North Bengal	0·19
North Behar	0·22
South Behar	0·78
Chutia Nagpur	0·32

The stations on the other hand in the Central Provinces, &c., affected by the storm were receiving heavy rain. Thus Saugor reported 6·44 inches, and Nagpur 5·64 inches, while Benares at some distance away from the storm received 2·24 inches, and Gya 2·81 inches.

The conditions on the 18th August were therefore somewhat different from those of the previous days. The storm, which was in West Behar on the 17th, was continuing its westerly course through the Central Provinces and Central India, and was almost ceasing to affect the weather in the province of Bengal, where light monsoon weather prevailed on this day. Fine weather generally obtained in the north-west angle of the Bay, and the low pressure area previously existing there had almost disappeared. Winds were due westerly at the Sandheads, while southerly breezes were blowing inland. Somewhat squally unsettled weather with heavy rain, prevailed a little to the north of the centre of the Bay, but elsewhere over the Bay, and at the coast stations, ordinary monsoon weather generally obtained.

19th August 1888.—The meteorological conditions in the Bay of Bengal, and over the land area to the north of it, are fully represented in the table below. In this table four sections are given, instead of three, the first three being the same as on previous days, while the fourth section gives similar meteorological data taken at 4 P.M. on the 19th, over the area where the storm began to show signs of development from the morning of the 20th. The distribution of barometric pressure and the wind directions, as represented in the first three sections of the table, are charted in Plate IX.

19th August 1888.

Hour.	Position of Station.		Station or Vessel.	Barometer.			Temperature.	Humidity.	Temperature previous 24 hours.		Wind.		Cloud proportion.	Rainfall.	Weather Remarks.
				Actual reduced to 32° and sea level	Change since previous 24 hours	Variation from normal.			Maximum.	Minimum.	Direction.	Velocity. Miles per hour.			
A.M.	A. Coast Stations.														
9-30	Ceylon		Galle	29·925	—·057	?	80·5	96	82·0	78·5	N.-W.	6	3	0·02	
9-30			Colombo	29·973	—·008	+·048	82·0	79	86·0	77·5	S.-W.	11	9	*Nil.*	
9-30			Trincomalee	29·875	—·028	?	87·5	64	97·0	77·0	W.	8	4	*Nil.*	
8	West Coast Bay.		Negapatam	29·863	—·014	+·041	84·0	78	95·0	76·7	S.-W.	4	7	0·26	
8			Madras	29·830	—·017	+·021	81·0	83	90·0	77·0	S.-W.	1	10	*Nil.*	
8			Cocanada	29·715	+·001	?	78·0	80	86·5	75·6	W.	4	10	1·41	Sea smooth.
8			Vizagapatam	29·698	+·031	+·025	81·5	73	90·3	79·1	W.	2	10	*Nil.*	
8			Gopalpur	29·624	+·017	+·022	81·0	87	84·7	79·8	S.-S.-W.	8	6	*Nil.*	Sea rough.
8			False Point	29·625	+·023	—·003	80·3	90	86·9	78·7	Calm	0	10	*Nil.*	
8			Balasore	29·631	+·037	?	79·5	93	89·4	77·7	Calm	0	10	1·10	
8			Saugor Island	29·621	+·015	—·031	79·7	96	84·2	77·5	N.	2	10	0·87	Sea slight.
8	East Coast Bay.		Chittagong	29·694	+·010	—·026	81·7	85	86·1	76·0	E.-S.-E.	4	3	0·15	
8			Akyab	29·717	—·005	—·04[illegible]	78·0	95	79·2	78·1	S.-S.-E.	4	10	0·73	
8			Diamond Island.	29·825	+·013	+·03[illegible]	80·4	85	84·9	73·5	S.-W.	8	5	*Nil.*	
8			Rangoon	29·856	+·026	+·027	78·1	92	84·1	74·4	S.-W.	[illegible]	8	1·46	Showery.
8			Tavoy	29·933	+·037	?	73·5	97	82·7	73·2	Calm	0	6	1·97	
10	Mid Bay		Port Blair	29·886	—·04	+·017	84·7	76	84·0	75·9	W.-S.-W.	7	7	*Nil.*	Squally.
10			Nancowry	29·925	+·019	+·013	87·8	74	87·4	76·8	S.-W.	5	6	*Nil.*	Cloudy.
	B. Sea Observations.														
A.M.	Lat. N.	Long. E.										*			
10	21°-02′	88°-46′	Mutla Light	29·639	+·031	—·051	78·9	94	...	...	Varible	1f	10	Amounts of rainfall not recorded.	Continuous rain.
10	21°-26′	88°-6′	Lower Gasper	29·633	+·037	—·042	79·9	91	...	..	S.-E.	2f	10		Slight southerly swell.
10	21°-14′	88°-11′	Intermediate	29·638	+·041	—·042	79·7	91	...	...	Calm	0f	10		Showers of rain.
10	20°-46′	87°-39′	Ridge Light	29·659	+·023	—·021	79·3	95	...	..	Varible	1f	2		Light rain.
8	...	...	P. V. *Coleroon.*	29·514	?	?	...	...	...	...	Southerly.	...	...		Overcast.
8	...		P. V. *Sarsuti*	29·613	+·020	—·067	...	...	...	...	Calm	...	..		Gloomy.
8	20°-32′	87°-33′	S. S. *Rohilla*	29·621	?	—·064	...		...	...	W.-S.-W.	4-5f	...		
8	Off Saugor		S. S. *Taisang*	29·645	?	—·007	...	.	...	...	W.	"			
8	9°-11′	84°-39′	*Dundrennan*	29·804	+·020	+·029	...	..	...	..	S.-W.	6f	.		
8	10°-26′	85°-40′	S.S. *Bancoora*	29·896	—·003	+·036	..	..	...	...	S.-S.-W.	6f	...		
8	At Chittagong		S.S. *Kapurthala*	29·695	—·010	—·035	...	...	...	...	S.	3f	...		Smooth sea.
noon	10°-53′	81°-08′	*First Lancashire*	29·960	+·050	?	...	...	...	...	Varible	...	...		
8	6°-43′	81°-59′	S.S. *Clan Mackay*	29·921	—·045	+·051	...	...	...	...	S.-Wly.	5f	...		Hazy.
8	8°-26′	86°-17′	*Toxteth*	29·920	—·050	+·035	...	...	...	...	W.-S.-W.	...	...		Heavy rain.
8	7°-38′	82°-28′	*Skolfield*	29·920	—·030	+·050	...	..	...	...	S.	6f	...		
8	19°-17′	89°-46′	S.S. *Chindwara*	29·680	?	—·050	...	...	...	...	Varible	3f	...		Heavy rain.
8	20°-45′	88°-12′	S. S. *Colaba*	29·689	—·040	?	...	...	...	...	N.	...	.		Squally with heavy rain.
8	17°-06′	86°-24′	S. S. *Lalpoora*	29·708	?	—·027	...	...	...	...	N.-N.-W.	6f	...		Heavy rain.
8	5°-19′	84°-54′	*Desdemona*	29·960	—·020	+·050	...	...	...	...	S.-W.	6f	...		Cross sea.
8	8°-23′	89°-45′	S.S *India*	29·940	0	+·045	...	...	...	...	S.-W.	3f	...		Cloudy.
8	9°-0′	78°-51′	S. S. *Tibre*	29·751	—·052	?	...	...	...	...	W.-S.-W.	6f	...		

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* In the column for velocity of wind, numbers marked "*f*" represent wind force on Beaufort's scale 0-12.

19th August 1888—continued.

Hours.	Position of Station.	STATION. OR VESSEL.	BAROMETER.			Temperature.	Humidity	TEMPERATURE PREVIOUS 24 HOURS.		WIND.		Cloud proportion.	Rainfall.	WEATHER REMARKS
			Actual reduced to 32° and sea level	Change previous 24 hours	Variation from normal.			Maximum.	Minimum.	Direction.	Velocity. Miles per hour.			
A.M.	C. INLAND STATIONS.													
10	Assam	Sibsagor	29·756	+·039	+·021	85·7	85	91·6	81·1	N.-E.	2	4	*Nil.*	
10		Silchar	29·729	+·044	—·021	85·7	79	91·5	77·2	Calm	1	9	0·16	
10		Dhubri	29·743	+·054	+·023	82·1	88	88·2	76·8	E.-N.-E.	4	10	0·83	
10	East Bengal	Dacca	29·700	+·049	+·017	85·6	75	87·1	78·2	E.-S.-E.	6	9	0·01	
10		Burrisal	29·690	+·040	—·003	83·7	83	85·3	77·8	S.-E.	4	8	0·03	
10		Furreedpore	29·713	+·053	+·007	82·6	84	84·5	78·4	S.-E.	5	5	*Nil.*	
10	S. W. Bengal	Jessore	29·688	+·063	+·010	82·5	86	86·2	78·4	E.	6	10	0·04	
10		Krishnaghur	29·697	+·064	+·023	83·7	83	86·4	76·8	E.-S.-E.	5	9	0·05	
10		Calcutta	29·664	+·056	—·024	82·4	81	86·0	77·2	E.	5	9	0·04	
10		Midnapore	29·676	+·053	—·013	82·5	87	89·3	75·3	N.-E.	2	6	0·40	
10		Balasore	29·667	+·057	+·002	80·5	93	89·4	77·7	Calm	8	10	1·10	
10		Berhampore	29·686	+·059	+·008	82·3	87	87·1	77·3	E.	5	10	0·23	
10		Burdwan	29·664	+·059	—·010	81·4	83	87·6	77·4	N.-E.	2	10	0·13	
10	Orissa	Cuttack	29·658	+·033	—·014	84·5	79	89·9	79·9	Calm	2	10	0·20	
10	Behar	Purneah	29·709	+·050	+·045	79·6	95	89·7	75·6	E.-N.-E.	3	8	2.13	
10		Durbhunga	29·698	+·065	+·048	82·0	83	86·4	77·3	E.-S.-E.	7	8	0·11	
10		Patna	29·669	+·055	+·012	83·1	85	83·8	77·2	E.	7	9	0·28	
10	Chutia Nagpur	Hazaribagh	29·650	+·055	—·015	76·0	85	82·4	71·7	E.-S.-E.	8	10	1·25	
10		Chyebassa	29·636	+·053	?	77·9	94	87·7	75·9	Calm	1	10	1·12	Overcast.
P.M.	D. STATIONS NEAR STORM AREA.										*			
4	S.-W. Bengal	Calcutta	29·552	+·025	—·024	77·5	95	85·9	77·1	S.-E.	6	10	0·30	Overcast
4		Saugor Island	29·533	+·013	—·037	83·0	87	84·4	77·6	S.	7	10	1·16	Gloomy.
4		Jessore	29·590	+·065	+·008	82·5	86	85·9	78·3	S.	7	9	0·35	Gloomy.
4		Burdwan	29·534	+·030	—·034	82·4	85	84·1	77·4	E.	3	10	0·53	Gloomy.
4	Orissa	Cuttack	29·584	+·063	+·018	80·6	?	86·4	79·9	W.-S.-W	1	10	0·43	Drizzling.
4		False Point	29·580	+·048	0	82·1	87	85·8	78·5	S.-E.	6	9	0·08	Gloomy.
4	East Bengal	Chittagong	29·593	+·015	—·053	88·7	68	89·9	75·7	S.-E.	4	5	0·15	Cloudy.
4	N.-W. Angle of Bay.	Mutla Light	29·561	+·034	—·043	79·8	93	...	.	S.-S.-E.	3*f*	10	Amounts of rainfall not recorded.	
4		Lower Gasper	29·535	+·049	—·040	81·9	83	...	...	S.-S.-W.	2*f*	6		
4		Intermediate	29·549	+·042	+·045	80·7	90	..	...	S.	2*f*	7		
4		Ridge Light	29·596	+·062	—·008	79·3	95	..	...	S.-S.-E.	1*f*	2		
4		P.V. *Coleroon*	29·589	+·025	—·015	..	.	...	...	S.-S.-E.	2*f*	...		*b, c.*
4		P. V. *Sarsuti*	29·517	0	—·087	.		...	...	Calm				

* In the column for velocity of wind, numbers marked "*f*" represent wind force on Beaufort's scale 0–12.

A considerable number of vessels were navigating the southern half of the Bay. These were the *Dundrennan*, *Bancoora*, *First Lancashire*, *Clan Mackay*, *Toxteth*, *Desdemona* and *India*. In the extreme south of the Bay as represented by the observations of the *Desdemona*, *Clan Mackay*, *Skolfield* and *India* in Lat. 5° to 8° N., ordinary monsoon weather with moderately strong south-westerly winds obtained. The *Toxteth*, in Lat. 8° 26′ N. and Long. 86° 17′ E. met with squalls and heavy rain. A little further north, the *Dundrennan* in Lat. 9° 11′ N. and Long. 84° 39′ E., reported a slightly rising barometer, a moderately strong south-westerly wind with a moderate swell and ordinary weather. The *Bancoora* in Lat. 10° 26′ N. and Long. 85° 40′ E., reported very similar weather. The *First Lancashire* in almost the same latitude and in Long. 81° E., that is, considerably nearer to the Madras coast, experienced, for the greater part of the day light and variable winds.

At the coast stations in the southern half of the Bay, weather conditions call for no remark; pressure was fairly steady, though it was falling slowly at the western stations and rising in the east of the Bay; south-westerly winds of moderate force prevailed at almost all stations, though at Port Blair the weather was reported to be squally. Light to moderate rain was also falling at a few stations.

In the centre, and towards the northern part of the Bay, there were few vessels from which logs have been received. The *Lalpoora* was in Lat. 17° 6′ N. and Long. 86° 24′ E. The weather she experienced was as follows: At 4 A.M. wind was variable; from 8 A.M. to 8 P.M. a fairly strong W.-N.-W. wind was reported, with heavy squalls and rain and rather high sea, and at midnight a tolerably strong west-south-westerly wind was blowing; the barometer continued steady throughout the day. The *Chindwara* was in Lat. 19° 17′ N. and Long. 89° 46′ E. Her log states that the wind on this day commenced at S.-W., then went to N.-E. to E., then to S.-E., and afterwards became variable, and finally settled down to S.-W. For the greater part of the day moderate to heavy rain showers were reported. The *Rohilla* was further north in Lat. 20° 32′ N. and Long. 87° 33′ E., and experienced a fresh W.-S.-W. wind in the early part of the day, but as she approached the Sandheads and Saugor Island, she had light variable winds, from N.-N.-E., N.-E. and S.-E. with rain at mid-day. The *Colaba*, a little further north than the *Rohilla*, in Lat 20° 45′ N. and Long. 88° 12′ E., experienced winds which commenced at S.-W., and became northerly, and variable as she approached Saugor Island, while weather was squally with heavy rain.

On board the pilot vessel *Sarsuti*, the wind during this day is reported to have been very light in force, and to have come from almost every point of the compass, while very heavy rain fell. On board the P. V. *Coleroon* winds were very variable in direction, and heavy rain and moderate sea were experienced. The *Meteor* Ridge Light vessel at the Sandheads (Lat 20° 46′ 30″ N. and Long. 87° 39′ 45″ E.) reported variable winds in the morning, and S.-S.-E. winds in the afternoon with unsettled weather, light rain and heavy southerly swell. The F. L. V. *Planet* Intermediate Station (Lat. 21° 14′ 45″ N. and Long. 88° 11′ E.) reported a calm in the morning, and a southerly wind in the afternoon with showers of rain, smooth sea and southerly swell. The F. L. V. *Canopus* at the Mutla station (Lat. 21° 02′ N. and Long. 86° 46′ 30″ E.) had very light variable winds in the forenoon, and light S.-S.-E. winds in the afternoon, the description of the weather in her log being "a heavy southerly swell, continuous light and heavy rain from 1 A.M. to noon, wind light and variable during the remainder of the day and weather finer." The F. L. V. *Hesperus* at the Lower Gasper Station (Lat. 21° 26′ 17″ N. and Long. 88° 6′ 48″ E.) reported on this day light S.-E. winds in the morning, and S.-S.-W. winds in the afternoon with ordinary weather. At the coast stations round the northern part, and more especially at the head of the Bay, moderate rain was falling and winds were variable in direction. At Balasore a calm was reported; at Saugor Island wind was northerly, velocity 2 miles an hour; at False Point it was calm;

at Calcutta it was E., at Jessore S.-E., at Burrisal S.-S.-E. and at Chittagong E.-S.-E. These observations indicate a feeble cyclonic circulation of winds Pressure was rising slowly over the northern half of the Bay, more particularly in the north-west angle, where the storm afterwards formed. But notwithstanding that pressure was rising over this area, at Saugor Island there had again arisen a defect relative to the surrounding stations. Thus at 8 A.M. of this day, the corrected pressures at Saugor Island and the neighbouring stations were as follows:—

Saugor Island	29·621	Midnapore	29·670"
Calcutta	29·638"	Jessore	29·663"
Balasore	29·631"	Burrisal	29·677"

Again, the following reduced pressures were recorded at 10 A.M.:—

Saugor Island	29·649"	Midnapore	29·676"
Calcutta	29·664"	Jessore	29·688"
Balasore	29·667"	Burrisal	29·690"

While at 4 P.M. the following readings were obtained:—

Saugor Island	29·533"
Calcutta	29·552"
Jessore	29·590"

These three sets of observations support one another and prove in the clearest possible manner that pressure at Saugor Island was low relatively to all the stations to the north, west and east of it. As pressure in August is usually higher at Saugor Island than in Central Bengal, it is evident that an area of deficient pressure overlay Saugor Island on this day.

Three facts come out here very clearly. First, that there was on the 19th a feeble and partial cyclonic circulation commencing at the head of the Bay; second, that the abnormal low pressure area had again reproduced itself near Saugor Island; and third, that there was general, and in some cases heavy, rain, near the area of relatively low pressure.

At the inland stations, conditions were practically unchanged since the previous day, both as represented by the 10 A.M. observations and by the 4 P.M. observations of the 19th. Pressure was rising steadily over the whole province of Bengal. At all the stations in the interior, a steady more or less easterly wind of moderate force was blowing The winds however in the south and south-west of the province were very light and somewhat irregular, though with a tendency towards cyclonic circulation, and in some cases the 4 P.M. observations showed that the wind directions were the reverse of those at 10 A.M. or 8 A M. Very light general rain was falling at the interior stations, and in East and North Bengal and in Behar the falls averaged about three or four-tenths of an inch. In South-West Bengal and Orissa, or in the neighbourhood of the position of the formation of the storm, rainfall was heavier, and the average fall was about seven-tenths of an inch. The heaviest falls were however received in Chutia Nagpur, where an average amount of 1·28 inches was received. The cause of this increased heaviness may perhaps be traced to the residual effects of the storm, which had passed through Behar two days before. The summary of the rainfall information on this day is given in the following table :—

RAINFALL FOR THE TWENTY-FOUR HOURS ENDING 6 P M.

19th August 1888.

DISTRICTS.	Average Rainfall
	Inch.
Orissa	0 65
South-West Bengal . . .	0 74
East Bengal	0 21
North Bengal . . .	0 43
North Behar	0·29
South Behar . . .	0·31
Chutia Nagpur .	1 28

In Central India the storm which was on the previous day between Sutna and Nowgong had continued its westerly movement, and on the 19th its centre was to the south-west of Jhansi. It was still a powerful storm, giving rise to rather heavy rainfall, and speaking generally, the storm in question was by far the most important feature of the meteorology of India on this day. The very strong easterly component which was noticeable in the wind-directions at the interior stations in the province of Bengal was also probably due to the indraught towards the storm in the Central Provinces.

The following, then, are the principal facts in the meteorology of the area under review on the 19th of August 1888: First, over the south of the Bay, ordinary monsoon weather obtained. In the centre and towards the northern part weather was slightly squally, and winds were apparently strengthening. Further north, and more particularly over the Sandheads and near the Sunderbuns, there was an area where light and very variable winds obtained, and where rain was falling rather heavily. Over this area therefore there must have been a certain amount of ascensional air motion. There is also abundant evidence to show that pressure was again comparatively low, close to or over the Sunderbuns as represented by Saugor Island. Further, there was a distinct tendency for a cyclonic circulation of winds to set up over this low pressure area. Nothing however in any way resembling a storm had been formed on this day, but there were, it will be seen, all the elements necessary for the generation of bad weather at the head of the Bay.

20th August 1888.—The meteorological data on which the discussion of the weather conditions of 20th August depends, are contained in the following table which is again divided into four sections, the first of these sections having reference to the morning observations at the coast stations round the Bay; the second, to those taken on the vessels navigating the Bay; the third to those of the inland stations in the province of Bengal; and the fourth section deals with the afternoon (4 P.M.) observations taken over the area where on this day the storm was forming. The wind directions and the barometric pressures over the northern part of the Bay and in Bengal are charted in Plate X.

20th August 1888

Hour.	Position of Station.		Station or Vessel.	Barometer.			Temperature.	Humidity.	Temperature previous 24 hours.		Wind.		Cloud proportion.	Rainfall.	Weather Remarks.
				Actual reduced to 32° and sea level.	Change since previous 24 hours.	Variation from normal.			Maximum.	Minimum.	Direction.	Velocity. Miles per hour.			
	A. Coast Stations.														
A.M.															
9-30	Ceylon .		Galle .	30·004	+·079	?	81·5	89	84·0	79·0	W.	10	2	*Nil.*	
9-30			Colombo .	29·991	+·018	+052	82·0	79	84·5	77·0	S.-S.-W.	13	4	*Nil.*	
9-30			Trincomalee .	29·909	+·034	?	86·0	65	92·5	77·0	S.-W	14	4	*Nil.*	
8			Negapatam .	29·872	+·009	+·047	81·4	74	93·4	76·2	S -W.	4	8	*Nil.*	
8	West Coast Bay.		Madras .	29 849	+·010	+ 027	79·0	91	90·0	73·5	S.-W.	5	10	0·46	
8			Cocanada .	29 751	+·036	?	80·0	85	86·5	75·6	W.	6	10	0·39	Sea smooth.
8			Vizagapatam	29·737	+·039	+·014	82·5	73	89·3	80·6	W.	2	10	*Nil.*	
8			Gopalpur .	29·674	+ 050	+·003	80·5	87	84·7	79·3	S.-W.	16	9	0·12	Sea rough.
8			False Point .	29·675	+·050	—·011	79 3	95	85·9	76·6	W.-N.-W.	4	9	0 17	
8			Balasore .	29·684	+ 053	?	80·5	89	82·4	77·7	Calm.	0	10	0·31	
8			Saugor Island	29·687	+·066	— 014	79·4	93	84·2	77·0	E.-N.-E.	6	10	1·04	Sea slight.
8	East Coast Bay.		Chittagong .	29·773	+ 079	—·023	80·7	84	90 1	77·0	E.	2	4	0·03	
8			Akyab . .	29·785	+·068	—·004	78·0	95	80 7	77·1	E.-S.-E	2	10	0·72	
8			Diamond Island . .	29·880	+·055	+·050	79·4	89	82·4	71·0	S -W.	6	8	1·11	
8			Rangoon .	29·903	+·046	+·056	76 6	94	82·1	74·4	S.-W.	?	10	1·00	
8			Tavoy . .	29·950	+ 017	?	73·0	97	79·2	72·2	Calm.	0	10	1·32	
10	Mid Bay. .		Port Blair .	29·963	+·077	+·072	84 7	76	87·2	77·9	S -W.	11	5	0·65	*c.*
10			Nancowry .	29 946	+ 021	+·016	88·8	71	88·8	77·2	S -W.	4	2	*Nil.*	*c.*
	B. Sea Observations.											*			
A.M	Lat. N	Long. E.													
10	21°-02′	88°-46′	Mutla Light .	29·705	+ 066	+·015	81 3	93	...	...	S.	3*f*	10	Amounts of rainfall not recorded.	
10	21°-26′	88°-6′	Lower Gasper	29·692	+·059	+·012	81·9	87	...	...	Varible.	2*f*	10		
10	21°-14′	88°-11′	Intermediate	29·689	+·051	+·009	80 7	90	..	...	E.	1*f*	9		Sea smooth.
10	20°-46′	87°-39′	Ridge Light .	29 716	+ 057	+·031	79 8	98	...	...	S.-W.	1*f*	2		Rainy weather.
8	...	...	P. V. *Sarsuti*	29·653	+·040	—·032	...	...		...	Calm	...	...		Rainy.
8	...	...	P. V. *Coleroon* . .	29·655	+·166	— 035	...	..	...	..	Calm	...	...		Overcast.
8	12°-30′	85°-40′	*Dundrennan*	?	?	?	...		...	...	W.-N.-W.	8*f*	..		
8	11°-41′	82°-36′	S. S *Bancoora*	29·844	— 050	+·024	...	...	...	...	S.-S.-W.	6*f*	...		
8	At Akyab .		S. S *Kapurthala* . .	29·810	?	+·028	...	...	...	...	E.	4*f*	...		
8	10°-00′	83°-20′	S S. *Clan Mackay* .	29·898	—·023	+·058	...	...	...	...	W.-S.-W.	5*f*	...		Fine weather.
8	12°-11′	86°-38′	*Toxteth* .	29·850	— 070	+·020	...	...	...	...	S.-W.	...	...		Threatening sky.
8	10°-36′	84°-10′	*Skolfield* .	29·910	—·010	+·065	...	...	...	...	S.-S.-W.	6*f*	...		
8	16°-49′	92°-36′	S. S. *Chindwara* . .	29·790	— 020	+·005	...	...	...	...	S.-W. by W.	5*f*	...		Overcast.
8	...	...	S. S. *Colaba* .	29·703	+·014	?	...	...	...	...	Varible.	...	...		
8	21°-8′	87°-52′	S.S. *Lalpoora*	29·646?	—·060	—·034	...	...	...	...	W. by S.	5*f*	...		
8	8°-22′	85°-5′	*Desdemona* .	29·930	—·030	+·050	...	...	...	...	S.-W.	6*f*	...		Sea cross.
8	12°-49′	84°-32′	S. S. *India* .	29·804	— 140	—·006	...	...	...	...	Varible.	2*f*	...		Sea moderately smooth.
8	At Kulpee.		*Champion* .	29·528?	?	?	...	...	...	...	Varible.	2*f*	...		Overcast.

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* In the column for the velocity of wind, numbers marked "*f*" represent wind force on Beaufort's scale 0-12.

20th August 1888—continued.

Hour.	Position of Station.	Station or Vessel.	Barometer.			Temperature.	Humidity.	Temperature previous 24 hours.		Wind.		Cloud proportion.	Rainfall.	Weather Remarks.
			Actual reduced to 32° and sea level.	Change since previous 24 hours.	Variation from normal.			Maximum.	Minimum.	Direction.	Velocity. Miles per hour.			
A.M.	C. Inland Observations.													
10	Assam	Sibsagar	29·783	+·027	+·029	88·3	79	93·1	80·6	N.-E.	2	2	*Nil*	
10		Silchar	29·769	+·040	+·006	87·7	77	94·0	79·2	Calm	3	7	*Nil.*	
10		Dhubri	29·798	+·055	+·068	78·0	92	85·7	75·3	Calm	6	10	0·12	
10	East Bengal	Dacca	29·740	+·040	+·040	82·5	83	89·1	78·2	E.-S.-E.	7	8	2·28	
10		Burrisal	29·732	+·042	+·025	82·7	87	85·3	77·3	E.	5	8	0·10	
10		Furreedpore	29·755	+·042	+·045	82·1	81	96·5	77·4	E.	6	8	0·40	
10	S.-W. Bengal	Jessore	29·723	+·035	+·028	84·4	86	85·7	77·4	E.	6	10	0·51	
10		Kushnaghur	29·737	+·040	+·062	80·7	93	85·9	76·8	E.	6	10	2·04	
10		Calcutta	29·701	+·037	—·011	82·4	83	86·0	77·2	E.-N.-E.	5	10	0·32	
10		Midnapore	29·725	+·049	+·018	83·5	74	85·3	76·3	Calm	1	3	0·77	
10		Berhampore	29·740	+·054	+·044	80·3	91	87·6	77·3	E.-N.-E.	7	10	0·12	
10		Burdwan	29·714	+·050	+·015	82·4	81	84·0	77·4	E.	3	10	1·31	
10	Orissa	Cuttack	29·685	+·027	+·001	84·0	77	86·4	77·3	Calm	1	8	0·80	
10	Behar	Purneah	29·762	+·053	+·073	82·6	83	87·7	73·6	E.	1	8	0·26	
10		Durbhunga	29·735	+·037	+·057	85·0	74	87·9	80·3	E.-S.-E.	11	6	*Nil.*	
10		Patna	29·741	+·055	+·047	81·6	87	84·9	77·2	E.	7	10	1·16	
10	Chutia Nagpur.	Hazaribagh	29·705	+·055	+·009	73·6	95	81·4	71·2	S.-E.	11	10	0·64	
10		Chyebassa	29·076	+·038	?	78·5	87	80·0	75·7	Calm	0	10	0·63	Gloomy.
P.M.	D.—Stations near Storm Area.										*			
4	S.-W. Bengal.	Calcutta	29·599	+·047	+·021	83·4	83	86·7	77·4	E.	4	10	0·08	Gloomy.
4		Saugor Island	29·616	+·083	+·043	84·1	83	84·7	77·2	S.-S.-E.	10	9	0·99	Overcast.
4		Jessore	29·664	+·074	+·080	83·4	86	85·4	77·5	S.-S.-E.	5	8	0·16	Gloomy.
4		Burdwan	29·618	+·084	+·046	82·4	81	85·9	77·4	E.	3	10	0·78	Gloomy.
4	Orissa	Cuttack	29·637	+·053	+·067	81·0	82	88·4	77·3	E.	1	10	0·46	Gloomy.
4		False Point	29·629	+·049	+·044	83·7	81	84·0	76·6	S.-S.-E.	5	9	0·20	Gloomy.
4	East Bengal	Chittagong	29·649	+·054	—·012	81·9	91	89·0	77·3	S.-S.-W.	5	5	0·03	Cloudy.
4	N.-W. Angle of Bay.	Mutla Light	29·595	+·034	—·009	83·3	89	...	...	S.-E.	3*f*	10	Amounts of rainfall not recorded.	
4		Lower Gasper	29·582	+·047	—·002	83·4	81	...	...	S.-S.-E.	2*f*	10		
4		Intermediate	29·605	+·056	+·011	82·7	82	.	.	S.-S.-E.	1*f*	9		Sea smooth.
4		Ridge Light	29·620	+·024	+·016	80·8	91	...	...	S.-E.	3*f*	2		Moderate swell.
4		P. V. *Coleroon.*	29·614	+·025	+·010	...	...	...	...	S.-E. by S.	1*f*			Cloudy.
4		P. V. *Sarsuti*	29·627	+·002	+·023	...	.	...	...	S.-E.	1-2*f*	..		Cloudy.

* In the column for the velocity of wind, numbers marked "*f*" represent wind force on Beaufort's scale 0-12.

The following vessels were navigating the southern half of the Bay: ***Desdemona, Clan Mackay, Skolfield, Bancoora, Toxteth, Dundrennan*** and ***India.*** The ***Desdemona*** in Lat. 8° 22′ N. and Long. 85° 5′ E. had ordinary S.-W. winds of force 6, with cross sea and clear weather. The ***Clan Mackay*** (Lat. 10° N. and Long. 83° 20′ E.) experienced W.-S.-W. winds of force 4—5 and ordinary weather, and the ***Skolfield*** a little to the N.-E. of the ***Mackay*** S.-S.-W. winds of force 6 with fine clear weather. The ***Bancoora*** in Lat. 11° 41′ N. and Long. 82° 36′ E., had S.-W. to S.-S.-W. winds of force 4 to 6, with dark cloudy weather and moderate S.-S.-W. sea. The ***Toxteth*** further to the north (Lat. 12° 12′ N. Long. 86° 38′), experienced in the early part of the day, strong south-westerly winds, but later on met fresh westerly winds with thick squally weather and heavy rain The *Dundrennan* (Lat. 12° 30′ N. and Long. 85° 40′ E.) in the early part of the day met with strong S.-W. winds which shifted to W. in the middle of the day with heavy squalls and rain, and backed to S.-W. in the evening. The *India* in Lat 12° 49′ N. and Long. 84° 30′ E. experienced similar weather to the *Dundrennan.*

At the coast stations in the southern half of the Bay, weather was of ordinary south-west monsoon character. Fairly strong south-westerly winds were blowing, and a few stations reported light rain. With reference to the pressure distribution, it is noticeable that while at all the coast stations in the southern half of the Bay, pressure was rising slowly, the barometric readings on board all the above-named vessels agree in showing that pressure over the sea-area was falling slowly, but the changes were small. Hence on the 20th of August the conditions over the southern half of the Bay were of ordinary monsoon character.

In the centre and towards the northern part of the Bay, there were only two vessels from which logs have been received, *viz*, the *Chindwara* and the *Kapurthala.* The *Chindwara* was in Lat. 16° 49′ N. and Long. 92°36′ E. and had S.-W. winds of force 5 to 6 with showery weather. The *Kapurthala* was near Akyab, and the day commenced with moderate S. S.-E. winds, which afterwards became easterly, force 4 She experienced a heavy S.-W. sea with cloudy weather and heavy rain throughout.

At Diamond Island a moderate south-westerly wind was blowing; while at Akyab a light E.-S.-E. wind was reported. At the stations on the Ganjam and South Orissa coasts winds were westerly and south-westerly, and at False Point a W.-N.-W. wind was blowing At all these coast stations pressure was rising, but the reading on board the *Chindwara* showed the pressure over the Bay to be decreasing. Light rain was also falling at the majority of these stations.

Conditions therefore on this day were fairly normal over the Bay as far north as about Lat. 19° N., but there the steady south-westerly monsoon current appears to have stopped, and its place was taken by easterly winds blowing at the eastern stations, and westerly winds at the western stations, indicating clearly indraught towards the sea-area, where also pressure was falling, though at the coast stations it was rising The showery weather which prevailed over this area proves that there was much ascensional air motion.

The observations made at the stations at the head of the Bay, and on board the light-ships, pilot vessels, &c., however have still to be considered. The *Lalpura* is the first vessel the observations of which are important. At noon on this day she was in Lat. 21° 8′ N. and Long. 86° 52′ E. The record of the day's weather is as follows: "4 A.M. and 8 A.M. wind W. by S., force 4-5; sea smooth; sky overcast. From noon to 8 P.M. variable winds, force 2 only with continuous heavy rain." She passed Saugor Island at midnight when the weather was cloudy. The P. V. *Sarsuti* was at anchor all day. During the early part of the day the atmosphere was quite calm, and from 10 A.M. to midnight wind was very light (force 1-2) and from a south-easterly direction. On board the P. V. *Coleroon* at 4 A.M. wind was W.; from daylight to nearly noon it was calm, with rainy weather, after which very light southerly winds were reported up till 8 P.M., when a fresh southerly breeze sprung up. On board the F. L. V. *Meteor*, Lat. 20° 46′ 30″ N. and Long. 87° 39′ 45″ E., light south-westerly winds were blowing in the morning, and S.-E. winds in the afternoon, and ordinary weather with rainy appearance was reported. On board the F. L. V. *Canopus* (Lat. 21° 02′ N. and Long. 88°46′ 20″ E.) wind was southerly and light in the morning, and S.-E. in the afternoon, and the description of the weather was "a heavy southerly swell during the early morning, passing rain showers during the remainder of the day, a light and moderate southerly breeze and fine. A heavy bank of clouds to the south-west." On board the F. L. V. *Planet*, Intermediate station (Lat. 21° 14′ 45″ N. and Long. 88° 11′ E.) very light easterly and south-easterly winds were reported in the morning and afternoon, with heavily clouded skies, smooth sea and southerly swell, and on board the *Hesperus* at the Lower Gasper station (Lat. 21° 26′ 17″ N. and Long. 88° 6′ 48″ E.) winds were light and variable in the morning, and in the afternoon a light S.-S.-E. wind was reported, the sky being overcast the whole day with slight sea only.

At the coast stations round the head of the Bay the wind directions in the morning showed a distinct tendency towards cyclonic circulation. At False Point wind was W.-N.-W., at Balasore it was calm, at Saugor Island and Calcutta E.-N.-E., at Chittagong E., and at Akyab E.-S.-E., but in all cases winds were very light. In the afternoon however the wind circulation was less definite. The centre of the somewhat irregular circulation which then existed, was over the land to the E.-N.-E. of Saugor Island. At False Point at 4 P.M. wind was S.-S.-E., at Cuttack E., at Saugor Island S.-S.-E., at the light-ships and pilot vessels S.-E. and S.-S.-E., at Calcutta E, and at Chittagong S.-S.-W. Pressure at the head of the Bay had continued to increase, and from the 19th up to 8 A.M. of the 20th there was a general rise of about a twentieth of an inch. But though pressure had thus risen over the area where apparently the storm was commencing to develop, pressure was still comparatively low over the Sandheads and Sunderbuns to the east of Saugor Island, the low-pressure area stretching apparently northwards from the Mutla light-ship, and including the Lower Gasper light-ship, and reaching to Calcutta. This is shown clearly by the meteorological data given in the table for 4 P.M., for while the observations on the light-ships at the Mutla and Gasper stations and at Calcutta show barometric readings below 29·6 inches, at Saugor Island, at Jessore, at the Ridge light-vessel, at the Pilot vessels, at False Point, &c., all the readings are considerably above 29·6 inches.

At the inland stations of Bengal, the meteorological conditions call for no remark. Wind directions were strongly easterly in almost all cases and of moderate force. Pressure also continued to rise slowly in all districts, and moderate rain was falling. The rainfalls were heaviest in Orissa and South-

West Bengal, where an average amount of nearly an inch was received and smallest in North Behar, as is shown in the following statement:—

RAINFALL FOR THE TWENTY-FOUR HOURS ENDING 6 P.M.

20th August 1888.

DISTRICTS.	Average Rainfall
	Inch.
Orissa	1·04
South-West Bengal	0·85
East Bengal	0·71
North Bengal	0·41
North Behar	0·15
South Behar	0·51
Chutia Nagpur	0·74

In Central India the storm, which had been in existence since the 15th August, continued its westerly advance, and was on this day in the south of Rajputana to the south-west of Neemuch. It was still an influential storm and gave moderate to heavy rain to a large area, including the greater part of Central and Northern India. It was also accompanied by moderate winds, and the wind circulation attending the storm occupied an exceedingly large area.

The principal features in the meteorology of August 20th were therefore as follows: Ordinary monsoon weather obtained over the greater part of the south and centre of the Bay. From the centre towards the northern part, squally weather with rather heavy rain and shifting winds prevailed. Pressure was also rising at the coast stations and falling over the Bay. Close to the land in the north-western part of the Bay, there was a very shallow low pressure area lying over the Sunderbuns close to Saugor Island, and stretching to Calcutta on the one hand and to the Mutla light-ship on the other. Over this area the winds were apparently very light and variable, but rain was falling in some places heavily and continuously Round this area there was a cyclonic circulation of winds, but winds were particularly feeble In the forenoon the centre of the wind circulation appeared to be to the south of Saugor Island, but in the afternoon the circulation was rather indefinite, and its centre, if it can be said to have had any definite centre, was over the Sunderbuns to the east or east-north-east of Saugor Island. Over Bengal weather was of normal monsoon character, though wind directions still showed indraught towards the storm in Central India and Rajputana, which was advancing in a westerly direction. Over Northern India generally, therefore, weather was of normal monsoon character, and moderate to heavy rain was falling. Hence on this day there was clear evidence of the storm commencing to form near the Sunderbuns not far from Saugor Island, and it is a noticeable point that this storm was forming while there was still the previous storm in full existence in Central India, and while the monsoon current continued to advance over Northern India.

21st August 1888.—The meteorological data on which the discussion of the weather of this date is based are contained in the following table, which, as on previous days, is divided into four sections, the first three giving the general meteorological data for the Bay of Bengal and of Bengal for the forenoon of that day, and the last giving the 4 P.M. data over the storm area itself. The wind observations and the barometric data for the morning observations are charted on Plate XI.

21st August 1888.

Hour.	Position of Station.	Station or Vessel.	Barometer. Actual reduced to 32° and sea level.	Barometer. Change since previous 24 hours.	Barometer. Variation from normal.	Temperature.	Humidity.	Temperature previous 24 hours. Maximum.	Temperature previous 24 hours. Minimum.	Wind. Direction.	Wind. Velocity, Miles per hour.	Cloud proportion.	Rainfall.	Weather Remarks.
A.M.	**A. Coast Stations.**													
9-30	Ceylon	Galle	30·002	—·002	?	82·0	91	85·5	80·0	W.	4	3	*Nil.*	
9-30		Colombo	30·004	+·013	+·056	82·5	79	84·5	76·0	S.-W.	12	7	0·02	
9-30		Trincomalee	29·931	+·022	?	85·0	68	98·0	77·0	S.-W.	10	5	*Nil.*	
8	West Coast Bay	Negapatam	29·910	+·038	+·067	81·4	76	91·5	78·8	S.-W.	4	8	*Nil.*	
8		Madras	29·879	+·030	+·033	83·0	77	89·0	76·5	S.-W.	7	4	*Nil.*	
8		Cocanada	29·757	+·006	?	79·0	87	88·5	77·6	W.	6	10	0·37	Sea smooth.
8		Vizagapatam	29·734	+·003	+·016	83·5	69	88·3	79·6	W.	2	10	*Nil.*	
8		Gopalpur	29·684	+·010	—·013	80·5	89	83·2	78·8	S.-W.	8	8	0·11	Sea rough.
8		False Point	29·682	+·007	+·005	77·8	95	83·9	75·6	W.	4	10	0·19	
8		Balasore	29·682	—·002	?	79·5	93	86·4	76·7	N.-N.-W.	4	8	0·06	
8		Saugor Island	29·672	—·015	—·018	79·4	95	84·7	79·5	N.-N.-W.	6	10	0·39	
8	East Coast Bay	Chittagong	29·736	—·037	—·005	78·7	91	89·1	77·0	S.-E.	4	7	0·23	
8		Akyab	29·773	—·012	0	76·0	98	79·2	77·1	S.-S.-W.	4	10	1·84	
8		Diamond Island.	29·892	+·012	+·067	75·9	91	83·9	71·0	W.-S.-W.	12	10	1·44	
8		Rangoon	29·905	+·002	+·047	76·1	96	80·6	73·9	S.-W.	?	10	1·29	
8		Tavoy	29·950	0	?	75·5	94	80·2	73·2	W.-S.-W.	2	10	0·79	
10	Mid Bay	Port Blair	29·924	—·039	+·049	83·7	79	86·0	75·9	W.-S.-W.	10	6	*Nil.*	
10		Nancowry	29·948	+·002	+·026	88·5	73	90·8	76·0	S. W.	3	4	*Nil.*	Cloudy.

Hour.	Lat N.	Long E	Station or Vessel.	Barometer. Actual reduced to 32° and sea level.	Barometer. Change since previous 24 hours.	Barometer. Variation from normal.	Temperature.	Humidity.	Temperature previous 24 hours. Maximum.	Temperature previous 24 hours. Minimum.	Wind. Direction.	Wind. Velocity, Miles per hour.*	Cloud proportion.	Rainfall.	Weather Remarks.
A.M.	**B. Sea Observations.**														
10	21°-02′-00″	88°-46′-30″	Mutla Light	29·649	—·056	—·041	78·9	94	...	...	W.-N.W.	4f	10	Amounts of rainfall not recorded.	
10	21°-26′-17″	88°- 6′-48″	Lower Gasper	29·641	—·051	—·029	77·9	95	..	...	N.-W. by W.	3f	10		
10	21°-14′-45″	88°-11′	Intermediate	29·629	—·060	—·051	78·7	91	...	..	N.-N.-W.	4f	10		
10	20°-46′-30″	87°-39′-45″	Ridge Light	29·690	—·026	0	83·3	87	..	...	W.	3f	3		
8	...	...	P. V. *Sarsuti.*	29·643	—·010	—·047	...			...	W.-N.-W.	4f	..		Overcast.
8	...	...	P. V *Coleroon*	29·603	+·025	—·087	...	·	...	...	W. N. W.	3f	...		Overcast and rainy.
8	15°-57′	86°-51′	*Dundrennan*	29·789	?	+·029	...	...	..	...	S W.	7f	...		
8	Madras Harbour		S S *Bancoora*	29·846	0	+·016	...	·	...	...	S. W.	...			
8	Off Kyouk Phyoo		S. S. *Kapurthala.*	29·783	—·030	+·013	...	...	..	...	S.	4f			Rain squalls.
8	14°-37′	83°-54′	*First Lancashire.*	29·810	—·050	+·020	...	...	...	...	S.-S.-W.	...	..		Sea smooth.
8	13°-31′	84°-40′	S. S. *Clan Mackay.*	29·878	—·020	+·078	...	...	...	...	W.-S.-W.	5f	...		Cloudy.
8	16°-13′	87°-16′	*Toxteth*	29·820	—·030	+·060	...	...	...	...	W.-S.-W.	...	...		
8	13°-41′	85°-36′	*Sholfield*	29·840	—·070	+·050	...	...	...	...	S. W.	5f	..		
7-30	No record.		S.S. *Loodiana*	29·580	?	?	...	...	...	...	N. E. to E.	...	...		
8	11°-42′	85°-46′	*Desdemona*	29·900	—·030	+·070	...	..	...	...	S. W.	7f	..		Heavy cross sea.
8	17°-35′	86°-00′	S. S. *India*	29·804	0	+·054	...	..	...	...	W.-S.-W.	5f	...		Cloudy with rough sea.
8	Mud Point.		*Champion*	29·576	—·092	?	...	...	...	...	N.-N.-W.	6f	...		Overcast.

* In the column for the velocity of wind, numbers marked "*f*" represent wind force on Beaufort's scale 0-12.

21st August 1888—continued.

Hour	Position of Station.	Station or Vessel.	Barometer.			Temperature.	Humidity.	Temperature previous 24 hours.		Wind.			Rainfall.	Weather Remarks.
			Actual reduced to 32° and sea level.	Change since previous 24 hours.	Variation from normal.			Maximum.	Minimum.	Direction.	Velocity, Miles per hour.	Cloud proportion.		
A.M.	C. Inland Stations.													
10	Assam	Sibsagar	29·792	+·009	+·026	87·2	82	94 6	79·6	S -E	3	8	*Nil.*	
10		Silchar	29·728	—·041	—·042	86·7	77	94·5	78·2	Calm.	2	9	*Nil*	
10		Dhubri	29·735	—·063	+·011	81 6	83	87·2	74 8	E.-S.-E.	5	5	0 37	
10	East Bengal	Dacca	29·716	— 024	+·007	84·1	80	88·1	76·7	E.-S. E.	5	9	1·18	
10		Burrisal	29·709	—·023	+·009	79·7	91	85·3	77·8	S.-S.-E.	5	10	0·65	
10		Furreedpore	29·728	—·027	+·018	82·6	81	85·5	77·9	E.	7	5	0·20	
10	S.-W. Bengal	Jessore	29·703	—·020	0	82·0	90	85·2	77·4	E.	5	10	0·96	
10		Kishnaghur	29·711	—·026	+·053	83·2	81	84·9	76·8	E.-N.-E.	5	10	1·12	
10		Calcutta	29·663	—·038	—·052	81·4	89	86·5	76·2	N.-N.-W.	4	10	0·70	
10		Midnapore	29·725	0	+·022	79·5	91	89·3	76·8	N.	3	7	0·20	
10		Balasore	29·699	+·008	+·008	80·5	93	86·4	76·7	N.-N.-W.	4	8	0·06	
10		Berhampore	29·712	—·028	+·008	82·3	85	84·6	77·3	E.-N.-E.	4	10	2·77	
10		Burdwan	29·703	—·011	—·002	76·9	93	86·0	77·4	N.-E.	3	10	0·98	
10	Orissa	Cuttack	29·709	+·024	+·015	81 5	85	88·4	76·3	Calm.	1	10	0·02	
10	Behar	Purneah	29·710	—·052	+·012	85 6	80	88·7	71·7	E.-S.-E.	2	3	0·02	
10		Durbhunga	29·716	—·029	+·024	85·5	76	88·9	78·3	E.-S.-E.	8	3	*Nil.*	
10		Patna	29 699	— 025	+·015	82·1	91	85·9	77·7	E.	8	10	0·48	
10	Chutia Nagpur	Hazaribagh	29·702	—·003	+·012	77·0	85	77 4	71·2	E.-S.-E.	8	10	0·4	
10		Chyebassa	29·686	+·010	?	81·7	79	84·5	75·7	Calm.	1	7	*Nil.*	*c.*
P.M.	D. Stations near Storm Area.										*			
4	S.-W. Bengal	Calcutta	29·544	—·055	—·038	83·3	79	84·7	76·2	E.-N.-E.	5	7	0·67	Gloomy, drizzling.
4		Saugor Island	29·500	—·116	—·079	77·9	97	79·5	77·4	W.-N.-W.	15	10	3·63	Overcast.
4		Jessore	29·592	—·072	+·004	80 5	9'	86·0	77·6	S.	6	8	0·96	Cloudy.
4		Burdwan	29·568	—·050	— 007	82·9	81	85·8	77·4	E.	2	10	1·20	Overcast, gloomy.
4	Orissa	Cuttack	29·612	—·025	+·036	79·0	89	84 8	76·2	W.-S.-W.	2	10	0·25	Overcast, rain.
4		False Point	29·602	—·027	+·008	80·8	80	81·2	75·6	S.-S.-W.	6	10	0·25	Overcast.
4	East Bengal	Chittagong	29·636	—·006	—·024	83·2	78	84·6	76·5	S.-E.	5	7	0·23	Cloudy.
4	N. W. Angle Bay.	Mutla Light	29·544	—·051	—·060	79·3	95	...	...	S.-W.	5*f*	10	Amounts of rainfall not recorded.	Continuous lightning, rain, from 4-30. A. M.
4		Lower Gasper	29·521	—·061	—·063	77·9	95	...	...	S.-W.	5*f*	10		Sea slight, rainy.
4		Intermediate	29·524	—·081	—·070	79·7	86	..	...	W.-N.-W.	4*f*	10		Sea slight, steady rain.
4		Ridge Light	29·599	—·021	—·005	81·3	87	...	...	W.	3*f*	3		Cloudy and rainy weather.
4		P. V. *Coleroon*	29·581	—·033	—·023	...		...	...	S.-W.	2*f*	...		Overcast and rainy.
4		P. V. *Sarsuti*	29·554	—·075	—·054	...	...	...	...	W. by S.	4*f*	...		Overcast.

* In the column for the velocity of wind, numbers marked "*f*" represent wind force in Beaufort's scale 0-12.

Over the southern half of the Bay the slight changes of meteorological conditions which had taken place since the 20th call for no comment. In the centre and towards the northern part of the Bay over the sea area, conditions were rapidly altering. Pressure, it is true, had scarcely changed, but wind directions as shown by the vessels *India*, *Toxteth* and *Dundrennan*, were becoming rather more westerly, while the wind force was rapidly increasing, and weather had become squally with heavy rain. The following is the description of the weather as given in the logs of these vessels: The *India* at noon was in Lat. 17°35′N, and Long 86° E., and was steaming up the Bay towards the Hooghly At 4 A.M weather was cloudy but fine, at 8 A.M heavy rain commenced and continued till 4 P M. when heavy squalls, high sea and thick incessant rain were experienced. The *Toxteth* was some little distance to the south-west of the *India* at noon, and during the day the south-westerly and west south-westerly winds freshened from being strong, up to a gale with violent squally weather, much rain and high cross sea. The *Dundrennan* was to the south of the *Toxteth*, and experienced more moderate weather with south-westerly winds of force 6—7. The *Tibre* which left Madras at noon on this day for Calcutta, in her northerly advance had at first fine weather, which continued until the following morning, when wind became west-south-west and gradually increased in force to a strong gale with a very high sea.

The 8 A M. meteorological observations at the coast stations on either side of the Bay, however, at this time gave absolutely no indication of the bad weather which was being experienced by these vessels At the coast stations round the northern part of the Bay from Akyab to Gopalpur, the following were the conditions. The barometer was falling very slowly from Akyab round to Balasore, at False Point and Gopalpur it was rising; the fall was largest at Chittagong, but even there for the 24 hours the fall was only 0·037 inch. Though this was the case at 8 A M., the 4 P M. observations on the other hand prove that conditions were rapidly changing. Thus, while at 8 A.M. of the 21st, at Saugor Island the fall for the previous 24 hours was 0·015 inch, at 4 P M. for the same day the fall for the previous 24 hours had increased to 0 116 inch, and pressure had fallen from 29·672 inches at 8 A.M, to 29·500 inches at 4 P.M. A rapid fall of pressure was thus occurring in the neighbourhood of Saugor Island on this day. A light south-south-west wind (velocity 4 miles an hour only) was blowing at Akyab. At Chittagong an equally light south-east wind was blowing (velocity 4 miles an hour); at Burrisal wind was south-south-east, velocity 5 miles an hour, and at Jessore wind was east and also 5 miles an hour. At Saugor Island and at Calcutta wind was north-north-west, the velocity at Calcutta being 4 miles an hour, and at Saugor Island velocity 6 miles only, a very small velocity for that station. At False Point wind was west, velocity 4 miles an hour, an extremely small velocity for that station, while at Gopalpur wind was south-west, velocity 8 miles an hour.

On board the light-ships and the pilot vessels at the head of the Bay the following were the weather conditions. On both the pilot vessels, the *Sarsuti* and *Coleroon*, the day commenced with fresh west-south-west winds, and very heavy rain; wind then became west-north-west, of force 3—4, for some hours, and south-west and west-south-west from about 4 P.M., with force increasing up to 5 and 6, with squally weather and moderate sea. On the *Méteor* (Ridge Light) cloudy rainy weather with moderate southerly swell and westerly winds, of force 3, was experienced; while from 10 A.M. of the 20th to the same hour on the 21st, the barometer had fallen 0·026 inch. On the *Hesperus* (Lower Gasper station) wind in the morning commenced at north-west by west, force 3, and in the afternoon it was south-west, force 5, with rainy weather and slight sea; while the barometer at 10 A.M. had fallen 0·051 inch. On the *Planet* (Intermediate station) wind in the forenoon was north-north-west, force 4, and in the afternoon west-north-west, force 4; at 10 A.M., in the previous 24 hours, the barometer had fallen 0·06 inch; while at 4 P.M., the fall for the 24 hours had increased to 0·081 inch. On the *Canopus* (Mutla station) continuous light rain was experienced from 4-30 A.M. up to noon, with a fresh breeze from the westward at 11 A.M., the direction being west-north-west, force 4, and at 4 P.M., south-west, force 5, while during the night weather appeared very unsettled, and wind increased to a fresh gale with high confused sea. Pressure at 10 A.M. had fallen 0·056 inch, and the fall was unchanged in amount at 4 P.M.

Taking all the observations of this date into consideration, and particularly those which have just been briefly alluded to, it would appear that at 8 A M. on the 21st, the centre of the storm was in about Lat. 21° 20′ N. and Long. 88° 50′ E., or about 30 miles north of the Mutla light-vessel, while at 4 P.M. of the same day, the small storm had advanced slowly in a north-north-west direction, and was just over the Sunderbuns, and perhaps 30 miles to the east of Saugor Island.

At the inland stations in South Bengal and Orissa, and indeed over a considerable part of Bengal on this day, wind directions showed a complete cyclonic circulation over the storm area, but the wind force was light. Thus at Cuttack it was calm, at Midnapore wind was north, 3 miles an hour, at Burdwan wind north-east, velocity 3 miles an hour, at Kishnaghur and Berhampore east-north-east, velocity 3—5 miles an hour. So that while extremely light winds or calms prevailed over a considerable part of South Bengal and Orissa, or over the whole of the northern half of the storm, at some little distance to the south of the storm, and even up to a distance of about 300 miles to the south of the centre, winds were approaching in force to a gale.

Generally speaking, over the province of Bengal on this day weather was of light monsoon character. Pressure was in most instances falling slowly, winds were light and were more or less influenced by the cyclonic circulation round the small storm, and moderate to heavy rain was falling, particularly in South-West Bengal and Orissa, as will be seen in the following table :—

RAINFALL FOR THE TWENTY-FOUR HOURS ENDING 6 P.M.
21st August 1888.

DISTRICTS.	Average Rainfall.
	Inch.
Orissa	1·35
South-West Bengal	0·89
East Bengal	0·44
North Bengal	0·35
North Behar	0·18
South Behar	0·33
Chutia Nagpur	0·26

In Central and Western India weather conditions were on this day still dependent on the storm which was continuing to advance in a westerly direction, and at 8 A.M., the centre of the depression was apparently crossing the Runn of Cutch. It was giving moderate winds and rather heavy rain, but it was so far from the province of Bengal that it had quite ceased to affect the weather over that area.

The principal features in the weather of the 21st August were therefore, first, the very gradual development of the storm at the head of the Bay, and its slow advance in a N.-N.-W. direction. At the centre of the storm, which was rather feeble on this day, the pressure was probably not lower than about 29·5 inches, or perhaps 29·45 inches. The storm gave rise to very light winds, in all quadrants except the south and even to the south of the centre for a distance of probably at least 60 to 80 miles winds were only of very moderate force; but to the south of this again, and even as far as about 300 miles from the centre, a strong gale prevailed. This was entirely confined to the area to the south of the storm, and the weather along the coast area on both sides of the Bay showed absolutely no sign of this stormy weather; while even the station of Diamond Island, which by its wind velocity usually shows the existence of strong winds in the Bay, on this day only reported a wind velocity of 12 miles an hour.

It must also be noticed again on this day there were two storms in existence one over the Runn of Cutch, and the second the storm which is being discussed in detail.

22nd August 1888.—The meteorological data on which the discussion of the weather of 22nd August depends, are given in the four sections of the following table, the first three sections dealing with the morning observations, and the fourth section giving the 4 P.M. data. The wind directions and barometric pressures of the forenoon are charted on Plate XII.

22nd August 1888

Hour.	Position of Station.	Station or Vessel.	Barometer.			Temperature.	Humidity.	Temperature previous 24 hours.		Wind.		Cloud proportion.	Rainfall.	Weather Remarks.
			Actual reduced to 32° and sea level.	Change since previous 24 hours.	Variation from normal.			Maximum.	Minimum.	Direction.	Velocity. Miles per hour.			
A.M.	A. Coast Stations.													
9-30	Ceylon .	Galle . .	29·998	—·004	?	81·5	89	84·5	79·5	N.-W.	6	4	*Nil.*	
9-30		Colombo .	29·998	—·006	+·059	83·5	81	85·5	75·0	S.-S.-W.	9	7	0·02	
9-30		Trincomalee .	29·921	—·010	?	87·5	60	98·0	77·0	S.-W.	10	4	*Nil.*	
8	West Coast Bay.	Negapatam .	29·901	—·009	+ 057	83·9	64	89·5	77·2	S.-W.	6	7	*Nil.*	
8		Madras .	29·898	+·019	+·040	80·0	78	91·5	76·0	W.-S. W.	7	9	*Nil.*	
8		Cocanada .	29·758	+·001	?	80·0	85	86·0	78·6	W.	8	10	*Nil.*	Sea smooth.
8		Vizagapatam	29·742	+·008	+·025	81·5	69	87·8	79·1	W.	4	10	0·10	
8		Gopalpur .	29·661	—·023	—·008	78·5	91	83·2	77·3	S.-W.	22	10	2·00	Sea rough.
8		False Point .	29·610	—·072	—·075	75·4	98	81·4	73·1	W.-S. W.	16	10	2·35	
8		Balasore .	29·581	—·101	?	78·5	93	83·4	75·7	W.-N. W.	8	10	1·02	
8		Saugor Island . .	29·530	—·142	—·145	77·4	100	79·7	76·5	W.-N. W.	8	10	4·85	

22nd August 1888—continued.

Hour.	Position of Station.		Station or Vessel.	Barometer.			Temperature.	Humidity.	Temperature previous 24 hours.		Wind.		Cloud proportion.	Rainfall.	Weather Remarks.
				Actual reduced to 32° and sea level.	Change since previous 24 hours.	Variation from normal.			Maximum.	Minimum.	Direction.	Velocity. Miles per hour.*			
A.M.	A. Coast Stations—*contd.*														
8	East Coast Bay		Chittagong	29·720	−·016	−·011	76·7	92	84·6	76·5	E.-S.-E.	6	10	0·20	
8			Akyab	29·781	+·008	−·020	77·5	93	79·2	77·6	S.-S.-W.	10	10	3·04	
8			Diamond Island	29·886	−·006	+·073	80·4	85	79·4	71·5	S.-S.-W.	10	6	3·24	
8			Rangoon	29·905	0	+·059	76·1	97	82·1	74·9	S.-W.	?	8	0·69	
8			Tavoy	29·958	+·008	?	75·0	95	78·7	72·2	Calm	0	10	0·84	
10	Mid Bay		Port Blair	29·941	+·017	+·065	82·7	81	87·0	75·9	S.-S.-W.	7	6	*Nil.*	Misty.
10			Nancowry	29·943	−·005	−·005	87·4	74	90·8	76·0	S.-W.	2	6	*Nil.*	Cloudy.
	B. Sea Observations														
A.M.	Lat. N.	Long. E													
10	21°-2′	88°-46′	Mutla Light	29·549	−·100	−·154	79·3	93	...	...	W.-S.-W.	7*f*	10	Amounts of rainfall not recorded.	
10	21°-26′	88°-6′	Lower Gasper	29·473	−·168	−·220	78·4	98	...	...	W.	5*f*	10		
10	21°-14′	88°-11′	Intermediate	29·540	−·089	−·153	78·7	90	...	...	W.	4*f*	10		Heavy rain.
10	20°-46′	87°-40′	Ridge Light	29·602	−·088	−·091	79·3	100	...	...	S.-W.	5*f*	3		Heavy cross sea.
8	...	...	P. V. *Coleroon*	29·584	−·096	−·109	..	...	...	...	W.-S.-W.	5*f*	...		Overcast.
8	...	...	P. V. *Sarsuti*	29·534	−·109	−·159	...	..	...	...	W.-S.-W.	6*f*	.		Overcast.
8	19°-18′	88°-13′	*Dundrennan*	29·669	?	−·044	...	...	..	...	...	8-10 *f*	...		
8	16°-38′	93° 54′	S. S. *Kapurthala*	29·854	+·071	+·036	...	.	...	...	S.-W.	3*f*	.		Passing rain; squally.
8	16°-58′	87°-07′	*First Lancashire*	29·660	?	−·092	...	..	.	...	W.-S.-W.	...	...		Overcast.
8	16°-55′	86°-21′	S. S. *Clan Mackay*	29·760	−·118	+·023	..	.		..	S.-W.	5*f*	..		Cloudy.
8	18°-56′	88°-27′	*Toxteth*	29·720	−·100	+·007	..	..	...	...	S.-W.	...	...		Violent squalls.
8	17°-2′	87°-04′	*Sholfield*	29·750	−·090	−·003	...	...	...	...	S.-W.	5*f*	...		Heavy squalls from W.-N.-W.
8	14°-57′	87°-24′	*Desdemona*	29·820	−·080	+·027	...	..	...	.	W.-S.-W.	...	..		Heavy cross sea.
8	21°-38′	88°-00′	S. S. *India*	29·502	−·030	−·181	...	...	...	...	W.-S.-W.	7*f*	...		Rough sea.
8	17°-0′	82°-28′	S. S. *Tibre*	29·665	?	−·068	...	...	...	...	S. S.-W.	3*f*	...		
8	Saugor.		*Champion*	29·497	−·079	−·184	...	...	...	...	N.-E.	8*f*	...		Heavy rain.
8	16°-31′	83°-41′	S. S. *Clan Macpherson*	29·783	?	+·030	...	..	...	...	W.-S.-W.	6*f*	...		Moderate sea.
8	...	...	S. S. *Euphrates*	29·697	−·130	?	...	...	...	...	S. by E	7*f*	...		Rainy.
A.M.	C. Inland Stations.														
10	Assam		Sibsagar	29·748	−·044	−·017	85·2	81	93·6	77·5	N.-E.	2	8	*Nil.*	
10			Silchar	29·740	+·012	−·027	83·6	83	96·6	78·2	E.	3	9	0·05	
10			Dhubri	29·707	−·028	−·002	84·6	78	86·7	77·3	E.-N.-E.	9	2	0·08	

* In the column for the velocity of wind, numbers marked "*f*" represent wind force on Beaufort's scale 0-12.

22nd August 1888—concluded.

Hour	Position of Station.	Station or Vessel.	Barometer.			Temperature.	Humidity.	Temperature previous 24 hours.		Wind.		Cloud proportion.	Rainfall.	Weather Remarks.
			Actual reduced to 32° and sea level.	Change since previous 24 hours.	Variation from normal.			Maximum.	Minimum.	Direction.	Velocity. Miles per hour.*			
A.M	C. Inland Stations—*contd.*													
10	East Bengal	Dacca	29'668	—'048	—'037	83'6	76	88'6	77'7	E.-S.-E.	10	9	0'11	
10	East Bengal	Burrisal	29'637	—'072	—'039	76'7	95	82'3	74'9	S.-E.	5	10	1'30	
10	East Bengal	Furreedpore	29'666	—'062	—'038	81'6	81	85'5	76'9	E.	10	10	*Nil.*	
10	S.-W.-Bengal	Jessore	29'615	—'088	—'085	81'5	86	86'2	77'4	E.	8	9	0'65	
10	S.-W.-Bengal	Kishnaghur	29'637	—'074	—'009	81'2	83	87'3	76'3	E.	10	9	0'14	
10	S.-W.-Bengal	Calcutta	29'565	—'098	—'144	80'4	85	84'5	75'7	N.-N.-E.	9	10	0'08	
10	S.-W.-Bengal	Midnapore	29'594	—'131	—'098	79'5	87	85'3	75'3	N.-E.	5	6	0'94	
10	S.-W.-Bengal	Balasore	29'579	—'120	—'120	79'0	91	83'4	75'7	W.-N.-W.	5	10	1'02	
10	S.-W.-Bengal	Berhampore	29'625	—'087	—'080	83'0	79	88'1	76'8	E.	9	7	0'08	
10	S.-W.-Bengal	Burdwan	29'593	—'110	—'106	80'4	82	86'0	77'4	E.	5	10	0'28	
10	Orissa	Cuttack	29'632	—'077	—'061	77'0	91	84'8	74'8	S.-W.	5	10	4'45	
10	Behar	Purneah	29'690	—'020	—'003	86'6	76	90'2	74'6	E.	2	3	1'12	
10	Behar	Durbhunga	29'695	—'021	+'007	87'5	73	89'9	79'3	E.-S.-E.	4	3	*Nil.*	
10	Behar	Patna	29'690	—'009	+'005	84'6	79	93'4	79'7	E.-N.-E.	4	8	*Nil.*	
10	Chutia Nagpur	Hazaribagh	29'668	—'034	—'020	76'5	87	82'4	72'6	N.-E.	7	0	*Nil*	
10	Chutia Nagpur	Chybassa	29'598	—'088	?	78'1	89	86'3	75'4	N.	1	10	0'38	
P M	D. Stations near Storm Area.										*			
4	S.-W. Bengal	Calcutta	29'453	—'091	—'136	80'3	87	83'9	75'5	E.-S.-E.	10	10	0'07	Overcast.
4	S.-W. Bengal	Saugor Island	29'400	—'100	—'188	81'2	93	81'9	76'4	E.-S.-E.	14	10	1'54	Overcast.
4	S.-W. Bengal	Jessore	29'501	—'091	—'093	79'5	92	83'0	77'4	E.	9	10	0'76	Overcast.
4	S.-W. Bengal	Burdwan	29'455	—'113	—'124	80'4	87	85'7	77'2	E.	6	10	0'17	Overcast, gloomy.
4	Orissa	Cuttack	29'508	—'104	—'076	77'0	91	77'0	75'0	W.-S.-W.	7	10	5'04	Rainy.
4	Orissa	False Point	29'495	—'[illegible]	—'108	76'0	95	77'8	73'2	W.-S.-W.	18	10	4'45	Overcast, rainy.
4	East Bengal	Chittagong	29'645	+'009	—'024	78'9	86	83'1	74'8	S.-E.	7	10	0'41	Overcast.
4	N.-W. Angle of Bay.	Mutla Light	29'431	—'113	—'186	78'4	97	..	...	S.-W.	6*f*	10	Amounts of rainfall not recorded.	Fresh gale.
4	N.-W. Angle of Bay.	Lower Gasper	29'354	—'167	—'253	78'9	95	...	.	S.-W.	3*f*	10		Southerly swell and rainy weather.
4	N.-W. Angle of Bay.	Intermediate	29'375	—'149	—'232	79'7	90	..	..	S.-W.	5*f*	10		Sea very rough.
4	N.-W. Angle of Bay.	Ridge Light	29'483	—'116	—'124	79'8	91	...		S.-W	6*f*	3		Cloudy weather.
4	N.-W. Angle of Bay.	P. V. *Coleroon*	29'461	—'120	—'146	.	.	.	..	S.-W. by W.	4*f*	...		Gloomy.
4	N.-W. Angle of Bay.	P. V. *Sarsuti*	29'434	—'120	—'173	...	...	..	...	W.-S.-W.	6-7*f*			Overcast.

* In the column for the velocity of wind, numbers marked "*f*" represent wind force on Beaufort's scale 0-12.

The conditions in the southern half of the Bay had undergone no important change, and they remained of ordinary monsoon character, with moderately strong south-westerly winds. In the middle of the Bay the *Clan Macpherson* was on her voyage from Madras to Calcutta, and at noon was at Lat. 16° 3′ N. and Long. 83° 41′ E., and experienced a moderate but increasing sea, with a W.-S.-W. wind of force 6—7. The *First Lancashire* was in Lat. 16° 58′ N. and Long. 87° 02′ E., and experienced fresh W.-S.-W winds and slight sea. The *Clan Mackay* in Lat. 16° 55′ N. and Long. 86° 21′ E. had somewhat squally weather. The *Skolfield*, a little further north in Lat. 17° 02′ N. and Long. 87° 02′ E., experienced south-west winds, force 5, during the early part of the day, and torrential rainfall and heavy squalls from W.-N.-W. during the latter part of the day, and a current was setting to the east. The barometer in the *Skolfield* had fallen 0·09 inch since the 21st. The *Toxteth*, which was further north, in Lat. 18° 56′ N. and Long. 88° 27′ E., reported a fall of the barometer from the 21st of 0·10 inch. The following is a description of the weather experienced: "From 4 A.M. to noon wind was south-west blowing a fresh gale with hard squalls, and high cross sea. From noon to midnight violent squally weather from the north-west with much rain, a hard gale from W.-S.-W., and a high cross sea were experienced, and the vessel was taking large quantities of water on board." The *Dundrennan* was a little further north, its position at noon being given as Lat. 19° 18′ N. and Long. 88° 13′ E. The barometer in this ship had also fallen nearly a tenth of an inch. Wind from 4 A.M., commenced at west with force 7, and by 8 A.M, it had increased to force to 8—10, and continued so till noon. The following is the general description of the weather experienced by this vessel: "In the morning strong squalls and heavy rain with a dirty appearance to south-west, west and north, heavy lightning to north-west. 8 A M. squalls very fierce. At 3 P.M , wind falling and weather clearing up." The conditions in the centre of the Bay, at some distance from the coast stations, as shown in these logs, may therefore be briefly summarized as follows: From Lat. 16° N. to about 18° or 19° N. strong south-west winds of about force 6—7 were blowing, which probably formed part of the strong indraught that was taking place towards the developing storm. North of 19° winds were west and of force rising to 8—10 or to a very strong gale, and these winds almost certainly formed part of the cyclonic circulation taking place about the depression, the centre of which was near Saugor Island. It may be remarked also that this strong gale of wind extended to about a distance of 200 miles from the storm centre.

At the coast stations to the east and west of this stormy area, the observations showed no trace of any impending bad weather. At such stations as Cocanada, Vizagapatam, and Gopalpur on the one side, and Diamond Island and Akyab on the other, pressure was almost steady, thus standing in sharp contrast to the fall of a tenth of an inch which had happened in the centre of the Bay. Ordinary south-westerly winds were generally reported, the velocity at Diamond Island being 10 miles an hour, at Akyab 10 miles, at Cocanada 8 miles, and at Vizagapatam 4 miles. Stronger winds were, however, reported at Gopalpur, and from the 21st to the 22nd the wind velocity averaged 22 miles an hour. Heavy rain was being received at some of the coast stations, Diamond Island and Akyab receiving between 3 and 4 inches, and Gopalpur 2 inches.

Thus the strong winds and stormy weather to the south of the storm, together with the falling barometer, were entirely confined to the centre of the Bay, and there was very little indication of the existence of these conditions at the coast stations.

Taking up now the observations made in the forenoon in the northern part of the Bay, north of Lat. 20°, and also the observations made in South Bengal and Orissa, it will be found that the storm had developed considerably. It has been shown that the centre of the cyclonic circulation of winds had moved on the afternoon of the 21st over the land a short distance to the east or the north of east of Saugor Island; while the lowest pressure was reported at Saugor Island, and the next lowest at the Lower Gasper light-ship. The observations of wind direction taken on the forenoon of the 22nd also indicate that the centre of the cyclonic circulation was over the Sunderbuns to the east of Saugor Island, showing that the storm had practically scarcely moved in the 16 hours since the afternoon of the 21st. Pressure had, however, fallen rather rapidly, the fall from the morning of the 21st to the 22nd equalling 0·168 inch at the Lower Gasper light-ship, 0·142 inch at Saugor Island, and a tenth of an inch and upwards at Balasore, the Mutla light-ship and the P. V. *Sarsuti*, while further away the falls were comparatively small. The maximum fall was, therefore, not quite coincident with the centre of the cyclonic circulation, in which case it should have been at Saugor Island, but it was distinctly to the south of the centre as indicated by the winds. Winds, again, over and near the land-area continued very light. The *Champion* was lying in Saugor Roads, and she reported a north-easterly wind, but this cannot be reconciled with the observations at Saugor Island, which is close to the centre and to the west or perhaps west-south-west of it, where wind was W.-N.-W. with a velocity of 8 miles an hour. At Calcutta, about 80 miles to the north of the centre, wind was N.-N.-E., velocity 9 miles an hour; at Jessore to the north-east of the centre, wind was east, velocity 8 miles an hour; and at Burrisal to the east of the centre, wind was south-east, velocity 5 miles an hour. It will thus be seen that to the west, west-south-west, north, north-east, and east of the centre, feeble cyclonic winds were reported. The condition of the sea-area to the south of the storm can be ascertained from the observations made on the light-ships. On board the *Hesperus* (Lower Gasper station) at 10 A.M. wind was west, and of force 5, and on board the *Planet* (Intermediate station) it was west and of force 4. At the Ridge light on the *Meteor*, wind was S.-W. and of force 5. These vessels were all to the south or south-west of the position of the storm centre, as judged by the wind motion. To the south or south-east of it on the *Canopus* (Mutla station), wind was W.-S.-W., and of force 7, so that winds were very much stronger to the south or south-east of the storm area than in any other position. On the *Hesperus*, *Planet*, and *Meteor* the weather is stated to have been unsettled with rather heavy rain and rough sea, whilst, on the *Canopus* for the 22nd it is described by the captain as follows: "A high cross sea, confused southerly and W.-S.-W. sea, a fresh gale and passing rain squalls, and continuous light rain from midnight up to noon. After noon, continuous heavy rain in squalls, wind very puffy; towards the evening wind and sea increased to a strong gale, but fell to a moderate gale between 10 P.M. and midnight, at which time it became as clear as day from south-west to north-west. I could see as far as the horizon between these two points, and as plainly as in ordinary daylight; as a matter of fact it was as light as day for at least 20 minutes."* The pilot brigs also on this day reported strong souwesterly winds and heavy squalls, the wind rising in force to about 6.

These observations, therefore, show that on the forenoon of the 22nd the storm centre was a little to the east or east-north-east of Saugor Island, and that to the west, north and east of the storm centre, light winds with heavily clouded skies obtained, but there was absolutely nothing in the land observations to show that the storm was one of any intensity. To the south of the centre and near the land, moderate winds were blowing, but both to the south-west and south-east of the centre at a distance of about 80 miles from it, as represented by the pilot vessels and the Mutla light-ship, winds were increasing in force to a gale. It is therefore a particularly noticeable fact that near the centre winds were light, and not to be compared in force with those experienced some 80 miles from the centre. Heavy rain was falling over the area near the centre as shown by the observations on the light-ships, &c., and at Saugor Island where nearly 5 inches of rain was recorded on this day.

At the stations in the interior of the province, the observations taken call for no comment. Pressure was falling slowly, winds were easterly, or in some cases north-easterly and light in force. General rain continued to fall. The rainfall recorded over the province on this day is shown in the following table. It will be seen that in Orissa the heavy general fall of 3·48 inches was reported, and that several stations received falls in excess of 4 and 5 inches. In other districts the falls only averaged a few tenths of an inch:—

RAINFALL OF THE TWENTY-FOUR HOURS ENDING 6 P.M.
22nd August 1888.

Meteorological Division.	Average Rainfall.	Heavy Rainfalls exceeding 3 inches.		
		District.	Station.	Amount.
	Inches.			Inches.
Orissa	3·48	Pooree	False Point	4 44
			Gop	3·50
		Cuttack	Jagatsingpore	5·00
			Cuttack	4·90
			Kendrapara	7 22
			Jaipore	5·23
			Dharmsalla	7·50
			Salipore	5 10
		Balasore	Chandbali	4·50
S.-W. Bengal	0 32	......	......	...
East Bengal	0 62	.. . .	......	...
North Bengal	0 21	......	......	...
North Behar	0·17	.....	......	...
South Behar	0·19	......	......	...
Chutia Nagpur	1·00	Hazaribagh	Semtagurah	3·93
			Karagdeha	4·80

The observations taken at 4 P.M. of the 22nd, as shown in the fourth section of the table before given, indicate that a remarkable change had taken place in the conditions since the morning. At Saugor Island at this time wind was east-south-east, velocity 14 miles an hour, and pressure was 29·400 inches, and there had been a fall of nearly a tenth of an inch since 4 P.M. of the 21st. At the Lower Gasper light-ship, only about 25 miles to the south of Saugor Island, pressure was 29·354 inches, and the fall since 4 P.M. of the previous day was ·167 inch, and wind was south-west of force 3. On board the *Champion* lying in Saugor Roads wind was north-east of force 7, with a pressure of about 29·360 inches. At the Intermediate station barometer was 29·375 inches with a fall of ·149 inch since the previous day, and wind was south-west of force 5. The centre of the storm was, therefore, both according to the wind directions and to the pressures recorded, between the Lower Gasper light-ship and Saugor Island, or about 20 or 30 miles to the south-west or south-south-west of the position of the centre at 8 A.M. on the same day. It has previously been seen that from 8 A.M. of the 21st to 8 A.M. of the 22nd, the centre of the wind circulation had moved, if anything, slightly in a southerly direction; but in the 8 hours from 8 A.M. to 4 P.M. of the 22nd, the centre of the wind circulation had certainly moved south-westward very distinctly.

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* A fuller account of this remarkable phenomenon is much to be desired. A similar occurrence is said to have been observed in the Calcutta Cyclone of October 1864, *vide* Report on the Calcutta Cyclone of October 1864, pages 92-93.—J. E.

This fact has, therefore, to be noticed in addition to the general summary of the weather conditions given for this day just previous to the discussion of the afternoon observations.

It will be shortly shown under the discussion of the weather for the 23rd August, that at 8 A.M. of that date the storm centre, as judged by the wind directions, had advanced to within about 25 miles south-east of Calcutta, and about 50 or 55 miles north-north-east of Saugor Island. After the 4 P.M. observations of the 22nd were made, it is evident, therefore, that the storm shortly commenced to move in a northerly direction, and during the evening of the 22nd the storm centre must have passed close to Saugor Island and to the east of it. This is confirmed by the self-recorded traces of wind direction obtained in the Beckley's anemograph at that station. These records will be more fully discussed later on, but they appear to show that the centre was passing close to Saugor Island soon after 8 or 9 P.M. on the 22nd August, for after that hour winds became more or less southerly, though they were very variable. The lowest barometer was not, however, recorded at this time at Saugor Island, and taking the detailed readings at this station which are discussed in a subsequent section, and allowing for the daily range of the barometer, it would appear that the position of lowest pressure or the centre of the barometric depression passed that station at about 10 A.M. of the 23rd, so that roughly the centre of the barometric depression passed the station 12 to 14 hours later than the centre of the circulation of winds.

23rd August 1888.—The ordinary data showing the meteorology of this day are contained in the four sections of the table below. The first section gives as usual the 8 A.M data of the coast stations round the Bay, the second portion deals with the observations taken over the sea-area, the third with the 10 A.M. observations at the inland stations in Bengal, &c., and the fourth section gives the 4 P.M. observations at the stations in the neighbourhood of the storm area, and from the light-ships, &c., at the head of the Bay. The principal facts of barometric pressure and wind direction at 10 A.M. are charted on Plate XIII.

23rd August 1888.

Hour.	Position of Station.		Station or Vessel.	Barometer. Actual reduced to 32° and sea level.	Barometer. Change since previous 24 hours.	Barometer. Variation from normal.	Temperature.	Humidity.	Temperature previous 24 hours. Maximum.	Temperature previous 24 hours. Minimum.	Wind. Direction.	Wind. Velocity. Miles per hour.	Cloud proportion.	Rainfall.	Weather Remarks.
A.M.	A. Coast Stations.														
9-30	Ceylon		Galle	29·986	—·012	?	81·5	89	84·5	78·0	W.-N. W.	4	4	*Nil.*	
9-30			Colombo	29·987	—·011	+·052	82·0	77	86·5	74·0	S.-S.-W.	9	5	*Nil.*	
9-30			Trincomalee	29·925	+·004	?	86·0	61	99·0	76·0	W.	10	5	*Nil.*	
8	West Coast Bay.		Negapatam	29·905	+·004	+·067	84·9	67	90·0	79·3	S.-W.	4	5	*Nil.*	
8			Madras	29·896	—·002	+·058	80·5	82	93·0	76·5	S.-W.	3	9	*Nil.*	
8			Cocanada	29·769	+·011	?	81·0	78	84·0	78·6	W.	8	7	*Nil.*	Sea smooth.
8			Vizagapatam	29·756	+·014	+·034	82·5	69	88·3	80·6	S.-W.	0	10	*Nil.*	
8			Gopalpur	29·683	+·022	+·010	78·5	86	78·7	76·8	S.-W.	12	10	0·95	Sea rough.
8			False Point	29·596	—·014	—·062	74·4	95	77·9	73·6	W-S.-W	28	10	6·24	
8			Balasore	29·522	—·059	?	76·5	93	84·4	74·8	W.	6	10	3·52	
8			Saugor Island	29·444	—·086	—·225	77·9	98	81·7	77·5	N.-N. W.	4	10	1·39	
8	East Coast Bay		Chittagong	29.673	—·047	—·055	75·6	92	83·1	?	S.-E.	6	10	1·02	
8			Akyab	29·762	—·019	+·028	79·5	91	79·2	77·1	S.-S. W.	0	10	0·98	
8			Diamond Island	29·906	+·020	+·078	79·4	87	81·4	72·0	S.-W.	6	6	1·18	
8			Rangoon	29·943	0	+·092	76·6	92	84·1	74·9	S.-E.	?	10	0·17	
8			Tavoy	29·988	+·030	?	74·5	94	81·7	74·2	N.-N. W.	0	10	0·16	
10	Mid Bay		Port Blair	29·933	—·008	+·065	84·7	76	86·0	77·9	S. W.	5	5	*Nil.*	Mist.
10			Nancowry	29·951	+·008	+·030	87·0	76	91·4	75·0	S.-E.	1	8	*Nil*	Cloudy.
	B. Sea Observations.														
A.M.	Lat. N.	Long. E.										*			
10	21°-02′	88°-46′	Mutla Light	29·370	—·179	—·343	77·4	100	..	...	W.-S. W.	12*f*	10	Amounts of rainfall not recorded.	
10	21°-26′	88°-6′	Lower Gasper	29·321	—·152	—·372	78·9	95	...	...	W. by S.	6*f*	10		
10	21°-14′	88°-11′	Intermediate	29·445	—·095	—·258	78·7	91	...	...	W.-S. W.	4*f*	10		Sea rough.
10	20°-46′	87°-40′	Ridge Light	29·622	+·020	—·081	78·8	94	...	...	S.-W.	6*f*	3		Sea very high.
8	...	...	P. V. *Sarsuti*	29·468	—·066	—·135	...	...	...	...	S.-W. by W.	9-10*f*	...		Overcast.
8	...	...	P. V. *Coleroon*	29·467	—·117	—·236	...	...	...	...	W.-S. W.	9*f*	...		*o, r*
8	20°-15′	88°-42′	*Dundrennan*	29·477	—·030	—·241	...	...	...	...	S.-W. by W.	8*f*	...		
8	17°-32′	92°-19′	S. S. *Africa*	29·847	—·090	+·039	...	...	...	...	S.-W.	5*f*	.		
8	20°-58′	88°-25′	*First Lancashire*	29·560	—·100	—·143	...	...	...	...	S.-W.	...	..		Overcast.
8	20°-25′	87°-45′	S. S. *Clan Mackay*	29·628	—·132	—·085	...	...	...	...	W.-S. W.	5*f*	..		Overcast.
8	20°-22′	87°-36′	*Toxteth*	29·720	0	+·007	...	...	...	...	S.-W.	...	..		Violent squalls with rain.
8	20°-30′	88°-15′	*Sholfield*	29·430	—·320	—·278	...	...	...	...	S.-W.	10*f*	..		Threatening.
7-40		...	S. S. *Loodiana*	29·270	—·010	?	...	...	...	...	...	...	..		Light N.-W. breeze.

* In the column for velocity of wind, numbers marked "*f*" represent wind force on Beaufort's scale 0-12.

23rd August 1888—continued.

Hour.	Position of Station.	Station or Vessel.	Barometer.			Temperature.	Humidity.	Temperature previous 24 hours.		Wind.		Cloud proportion.	Rainfall.	Weather Remarks.
			Actual reduced to 32° and sea level.	Change since previous 24 hours.	Variation from normal.			Maximum.	Minimum.	Direction.	Velocity. Miles per hour.			
	B. Sea Observations—*contd.*													
A.M.	Lat. N. Long. E.										*			
8	18°-16′ 88°-33′	*Desdemona*	29·730	—·090	—·018	...	...	...	...	S.-W.	8*f*	...	Amounts of rainfall not recorded.	Heavy sea.
8	19°-34′ 88°-05′	S. S. *Tibre*	29·525	—·140	—·193		...	...	...	W.-S.-W.	4*f*	...		
8	Eastern Channel	*Champion*	29·470	0	—·233	...	...	...	...	W.-S.W.	9*f*	...		Ra'n and squalls.
8	20°-5′ 87°-11′	S. S. *Clan Macpherson*	29·627	—·156	—·086	..	...	...	...	S.-W.	...	..		Squalls.
8	Chittagong	S.S. *Euphrates*	29·700	—·010	—·063	...	...	...	...	S. by E.	7*f*	...		Strong breeze.
	C. Inland Stations.													
A.M.														
10	Assam	Sibsagor	29·757	+·009	—·006	79·1	93	93·1	80·6	S.-W.	2	10	0·02	
10		Silchar	29·730	—·010	—·035	81·6	83	89·5	75·8	E.-S.-E.	4	10	0·18	
10		Dhubri	29·706	—·001	—·003	81·6	77	87·7	75·8	E.-S.-E.	10	10	0·17	
10	East Bengal	Dacca	29·599	—·069	—·105	76·0	98	85·1	75·1	E.	14	10	0·36	
10		Burrisal	29·558	—·079	—·122	77·7	95	79·8	75·9	S.-E.	10	10	3·46	
10		Furreedpore	29·572	—·094	—·124	77·1	95	82·5	75·9	E.	13	10	0·40	
10	S.-W. Bengal.	Jessore	29·462	—·153	—·236	79·0	96	83·2	77·4	S.-E.	13	10	0·64	
10		Kishnaghur	29·503	—·134	—·145	78·7	95	84·9	75·8	E.-N.-E.	14	10	0·38	
10		Calcutta	29·419	—·146	—·282	78·4	95	84·0	75·7	N.-N.-E.	8	10	0·15	
10		Midnapore	29·506	—·088	—·175	76·6	91	85·8	75·7	N.	12	10	0·67	
10		Balasore	29·528	—·051	—·145	77·0	93	84·4	74·8	W.	5	10	3·52	
10		Berhampore	29·550	—·075	—·151	78·3	89	86·1	76·3	E.-N.-E.	13	10	0·21	
10		Burdwan	29·479	—·114	—·216	76·9	93	85·4	76·4	N.-E.	8	10	0·73	
10	Orissa	Cuttack	29·653	+·021	—·036	76·5	88	76·8	74·3	S.-W.	8	10	6·02	
10	Behar	Purneah	29·660	—·030	—·026	85·6	76	90·7	73·6	E.	3	4	0·46	
10		Durbhunga	29·675	—·020	—·002	84·5	91	90·4	77·8	E.-N.-E.	7	6	0·74	
10		Patna	29·661	—·029	—·020	83·6	77	91·4	76·2	E.	4	6	0·36	
10	Chutia Nagpur	Hazaribagh	29·640	—·028	—·048	74·6	91	82·4	71·2	N.-E.	13	10	0·72	
10		Chybassa	29·582	—·016	?	82·0	79	82·4	74·1	W.	2	8	1·85	
	D. Stations near Storm Area.										*			
P.M.														
4	S.-W. Bengal	Calcutta	29·343	—·110	—·249	78·4	95	80·0	75·8	E.	9	10	0·53	*o. g. d. p.*
4		Saugor Island	29·382	—·018	—·209	76·9	97	80·8	77·6	S.-W.	32	10	8·99	Continuous rain.
4		Jessore	29·367	—·134	—·231	79·5	93	81·8	77·2	S.-E.	13	10	0·65	Overcast, rainy.
4		Burdwan	29·349	—·106	—·231	77·9	90	85·7	76·4	N.-N.-E.	10	10	0·80	Overcast, strong wind.
4	Orissa	Cuttack	29·577	—·069	—·014	79·0	87	78·3	74·4	S.-W.	8	10	5·67	Rainy.
4		False Point	29·539	+·044	—·070	77·3	91	77·5	73·6	W.-S.-W.	23	10	5·35	Overcast, rainy.
4	East Bengal	Chittagong	29·647	+·002	—·026	74·6	96	80·9	74·8	S.-S.-E.	8	10	0·97	Overcast, rain, heavy rain.
4	North-West Angle Bay	Mutla Light	29·313	—·118	—·314	77·9	99	...	...	W.-S.-W.	9*f*	10	Amounts of rainfall not recorded.	Squally, hard gale.
4		Lower Gasper	29·305	—·049	—·302	77·9	95	...	...	W.	9*f*	10		Sea thick, heavy squalls, rainy.
4		Intermediate	29·398	+·023	—·219	78·7	90	...	...	S.-W.	10*f*	10		Sea very rough, heavy rain and gale.
4		Ridge Light	29·602	+·119	—·015	77·8	96	...	...	W.	6*f*	8		Sea high, rain and gale.

In the column for velocity of wind, numbers marked "*f*" represent wind force on Beaufort's scale 0-12.

23rd August 1888—concluded.

Hour.	Position of Stations.		STATIONS OR VESSELS.	BAROMETER.			Temperature.	Humidity.	TEMPERATURE PREVIOUS 24 HOURS.		WIND.		Cloud proportion.	Rainfall.	WEATHER REMARKS.
				Actual reduced to 32° and sea level.	Change since previous 24 hours.	Variation from normal.			Maximum.	Minimum.	Direction.	Velocity. Miles per hour.			
	D. STATIONS NEAR STORM AREA—*concld.*											*			
P.M.	Lat. N.	Long E.													
4	...		P. V. *Coleroon*	29·481	+·020	—·136	...	...	...	...	W.-S.-W.	10*f*	..	Amounts of rainfall not recorded.	Hard westerly squalls.
4	..	...	P. V. *Sarsuti*	29·549	+·115	—·068	...	..	...	...	S.-W.	8*f*	..		Squally and overcast.
4	20°-5′ .	87°-11′ .	S. S. *Clan Macpherson.*	29·485	—·162	—·142	...	...	...	...	S.-W.	8*f*	..		Cloudy.
4	19°-34′.	85°-48′ .	S. S. *Tibre* .	29·341	—·214	—·291		..	...	...	W.-S.-W.	10*f*			
4	20°-15 .	88°-42′ .	*Dundrennan.*	29·477	+·003	—·155	...	...	. .	...	S.-W. by-W.	8*f*	..		Squalls and heavy rain.
4	20°-58′ .	88°-25′ .	*First Lancashire.*	29·560	—·050	—·057	...	...	...	...	S.-W.	...	.		Sea high, hard gale, violent squalls.
4	13°-31′ .	84°-40′ .	S. S. *Clan Mackay.*	29·496	—·156	—·131	...		..	...	W.-S.-W.	7*f*	..		Heavy rain.

* In the column for velocity of wind, numbers marked "*f*" represent wind force on Beaufort's scale 0-12.

Taking up first the observations relating to the Bay—In the southern half there were a few vessels, including the *City of Edinburgh*, *Nerbudda*, *County of Selkirk*, *Engineer*, and *Culna*, the logs of which are not given in the table, as they only show that ordinary monsoon weather obtained in the south of the Bay with south-westerly winds of force 3 and 4. In Lat. 15° and 16° N., as represented by the *Culna*, weather was beginning to be somewhat squally with south-westerly winds of force 5 and 6. A little north of this, in Lat. 17° 32′ N. and Long. 92° 19′ E., as shown by the log of the *Africa*, south-westerly winds of force 6 and 7 were blowing, and the barometer had fallen 0·09 inch during the previous 24 hours. Weather was very squally, and there was a heavy sea rolling. Again, north of this was the *Tibre* which at noon was in Lat. 19° 34′ N. and Long. 88° 05′ E. Her barometer had fallen 0·14 inch, and she experienced a W.-S.-W. wind throughout the day; in the early morning the force was from 2 to 4, but by noon it had increased to force 6; at 3 P.M. the pilot brig was sighted under bare poles; at 4 P.M. wind force was 10, and at 7 P.M. the Eastern Channel light-ship was sighted. It was then blowing a heavy gale from S.-W. by W. with a high sea, and there were frequent squalls of hurricane force and blinding rain. Similar weather continued throughout the night. This log therefore shows that up to Lat. 19° 34′ N., the storm area had not been entered, but that as the *Tibre* continued in her northerly course, and neared the position of the pilot brigs, she encountered the full force of the storm. The observations taken in the Bay hence show that the storm area was north of Lat. 20° N.

The meteorological observations taken at the coast stations round the greater part of the Bay, excepting those close to the storm, show practically no sign of the existence of the fierce storm. Winds were generally south-westerly and of moderate velocity, ranging from 8 to 12 miles an hour at the west coast stations from Lat. 20° N. southwards, and pressure was steady, rising slowly at a few stations and falling at others. On the east coast of the Bay from Akyab southwards winds were generally south-westerly, and the velocities in no case exceeded 5 or 6 miles an hour. Even at Diamond Island, which by its increased wind velocities generally shows the existence of any stormy weather in the Bay, the velocity averaged only 6 miles, while on the previous day, it had averaged 10 miles, thus pointing to weather conditions being quieter if anything than on the previous day. Pressure was also rising on the Pegu coast and falling slowly on the Arakan coast. Hence there were at the coast stations from Lat. 20° N. southwards, absolutely no indications of the very fierce and stormy weather then existing in the Bay itself.

To the north of Lat. 20° N., however, over the sea area conditions had changed exceedingly rapidly for the worse since the 22nd. The conditions over that area are shown by the logs of six vessels which were between Lat. 20° and 21° N. and by the four light-ships and the two pilot brigs. The *Clan Macpherson* was in Lat. 20° 5′ N. and Long. 87° 11′ E. The barometer in this vessel at 8 A.M. was 29·627 inches, representing a fall of 0·156 inch since the previous day. She experienced south-westerly winds ranging up to force 9 during the day The description of the weather given in her log is as follows: "Short hollow. sea running. Rain almost continuous from midnight in very heavy squalls. Current setting to N.-E. Grey rain clouds driving rapidly across the sky, with at times heavy black rain clouds. Sky completely overcast. No break." The *Dundrennan* was at noon on this day in Lat. 20° 15′ N. and Long. 88° 42′ E. Her barometer read 29·477 inches and had fallen only 0·030 inch since the previous day. She experienced W.-S.-W. to S.-W. winds of about force 8 the whole day, and the description of weather given is as follows: ' A.M.—Gale increasing and sea rising from S.-W. Ship straining heavily. Noon—Fierce squalls and heavy rain. 10 P.M.—Wind and sea moderating. Midnight—Gale increasing with heavy rain."

The *Toxteth* was a little further north, her position at noon being Lat. 20° 22′ N. and Long. 87° 36′ E. She experienced fresh S.-W. winds in the early morning, but they increased in force to a strong gale at noon, and to a "hard gale at 4 P.M., with violent squally weather and much rain." The *Clan Mackay* was a little further north, her position at noon being given as Lat. 20° 25′ N. and Long. 87° 45′ E. She experienced W.-S.-W. winds of force 6—7 with hard squalls and heavy rain during the afternoon. The reading of the *Clan Mackay's* barometer was 29·628 inches, and there had been a fall in the previous 24 hours of 0·132 inch.

The *Skolfield* was in Lat. 20° 30′ N. and Long. 88° 15′ E. at noon (*i.e.*, only a short distance from the *Clan Mackay*). She registered a pressure of 29·430 inches, which would represent a fall of 0·320 inch since the previous day. It is almost certain, however, that this reading is incorrect, for in the position of the ship with reference to the storm the pressure was almost certainly rather more than a tenth of an inch higher than this. The *Skolfield* experienced S.-W. winds of force 10 during the day. The following is the description of the weather in her log: "First part of day—Fresh breeze and cloudy. Morning—Wind increasing rapidly, with very threatening appearance and much thunder and lightning. Noon—Blowing a furious gale; rain falling in torrents."

Further north was the *First Lancashire*, which at noon was in Lat. 20° 58′ N. and Long. 88° 25′ E. The pressure registered was 29·560 inches, which agrees fairly well with its position with reference to the storm. There had been a fall of a tenth of an inch in the previous 24 hours. The *First Lancashire* experienced strong south-westerly winds the whole day, and from mid-day she had strong winds and squally weather, and later on an increasing gale.

Taking up next the observations made on the pilot brigs:—The *Coleroon* reported a pressure of 29·467 inches, or a fall in the 24 hours of 0·117 inch, and experienced W.-S.-W. winds of force 9—10. The following is the description of the weather experienced. "Daylight—Hard westerly wind with heavy squalls and much rain, and heavy rising sea. 5-30 A.M.—Hard westerly squall. Noon—Whole gale from W.-S.-W. with heavy squalls, blinding rain and very high sea. 8 P.M.—Strong W.-S.-W. gale with heavy squalls, thick overcast weather and much rain. Sea very high." On the *Sarsuti* the barometer at 8 A.M. was 29·468 inches, representing a fall of 0·066 inch in the 24 hours. She also experienced S.-W. and W. winds during the day, the force rising from 7 in the morning to 10 during the greater part of the day, though it fell to 7 again at night. The weather is thus described· "4-30 A.M.—Blowing very hard 6-30 A. M.—Fore-topmast stay-sail blew away. 4-45 P.M.—Sea moderating, but still squally. 8 P.M.—Blowing a moderate gale; heavy squalls with moderating sea." On the Mutla light-ship (the *Canopus*) wind was W.-S.-W. with a force of 12 in the morning at 10 A.M., or a full hurricane, and of force 9 at 4 P.M., while the recorded pressure at 10 A.M was 29·370 inches giving a fall of 0·179 inch since the previous day. This decidedly low reading is supported by the reading on board the *Hesperus* where pressure was 29 321 inches. The two readings are also supported by the 4 P.M. observations at the same stations, for at that hour pressure on the *Canopus* was 29·313 inches, and on the *Hesperus* 29 305 inches. This low pressure centre has not been able to be clearly represented on Plate XIII, and it would appear probable this low pressure or barometric minimum was many miles to the south of the centre of the wind circulation. The following is a description of the weather on the *Canopus* given by Mr. Braham, the commander: "Between midnight and 4 A.M. the wind again increased to a hard gale, attended with blinding terrific rain squalls, and very high confused southerly and W.-S.-W. seas, which became heavier as the wind increased. At 8 A.M. the wind was blowing with full cyclonic force, the sea one mass of foam; between the salt sprays and heavy blinding rain the forepart of the vessel was not visible. This lasted up to 2 P.M. Between 2 and 10 P.M. there was a slight lull in the gale, but the sea kept up. 6 P.M.—Barometer 29·480 inches (corrected 29·35 inches), lowest reading. Between 10 P.M. and midnight the gale again increased to cyclonic force. During the gale the scud was very low, and between 1 and 2 P. M. on this day, I got a sight of the sun; the upper clouds at that time were going from west towards east, but the motion was very slight indeed. I consider the force of wind in this gale exceeded the force of wind in the late cyclones of 1885 and 1887."

On the *Meteor* at the Ridge Light station the recorded pressure was 29·622 inches which represents a rise of ·020 inch since the same period of the previous day. This reading is probably erroneous, the reading being certainly a tenth of an inch too high. At 10 A. M. wind was west with force 6, and the weather is described as "blowing a gale with torrents of rain and very high sea;" while at 4 P. M. wind was also west, of force 6, blowing a heavy gale, with torrents of rain and a very high sea. At the Intermediate station on board the *Planet* pressure was 29·445 inches, giving a fall of 0·095 inch since the previous day. This accords well with the position of the light-ship in reference to the storm. At 10 A. M. wind was S.-W. of force 4 only, but by 4 P. M. the force had risen to 10. Very rough sea and heavy rain were also recorded throughout the day. At the Lower Gasper station on board the *Hesperus* the recorded pressure was 29·321 inches, representing a fall of 0·152 inch; but this pressure does not agree with that recorded at Saugor Island, which is 13 or 14 miles from the Lower Gasper station, where the pressure was 29·444 inches; but, as stated before, the reading may be accurate, as it is confirmed by the readings on the *Canopus*. On the *Hesperus* wind was W. by S. at 10 A. M. and of force 6; but at 4 P. M. wind was W. and of force 9, and the description of the weather given was "nasty sea, thick rainy weather, heavy sea, heavy squalls of wind and rain from S.-W. to W.-N.-W."

Three vessels were also coming out from Saugor Roads on this day, the S. S. *Ooryia*, the S. S. *Loodiana*, and the Ship *Champion* in tow of the *Clive*. The following is the description of the weather experienced by the *Ooryia* as given by Captain Spence: "Thursday morning, 23rd August 1888, 5-30 A. M.—Barometer 29·52* inches (corrected about 29·36 inches). Wind light N.-W., but dense clouds hanging all round and very heavy rain. Thinking that by going to the southward I should get out of the dirty weather, and as there was and had been but very light wind, I got under weigh and went down the Western Channel. The weather cleared up a little about 7 A. M., and the wind freshened up from the N.-W. and it remained so until 11 A. M., when the wind flew to west, and blew with terrific force and very heavy rain. By this time we were about 25 miles S.-S.-W. of Saugor; we had a very heavy sea. Stood south, the wind blowing a steady gale W.-S.-W., and barometer remaining stationary at 29·50 inches (corrected 29·34 inches) until 7 P. M. At this time we were west of the Eastern Channel light vessel; the wind here hauled S.-W., blowing a hard gale, and constant rain. From this time the barometer rose steadily to 29·60 inches (corrected 29·44 inches) at midnight. Position at this time S.-W. of Eastern Channel light-ship, about 18 miles. I stood then to the westward. About 3 A. M., Friday, the rain ceased, but the wind held on very strong S.-W. By daylight on Friday morning we were about 15 miles south of the Ridge light-ship, the weather ordinary monsoon, strong wind and barometer 29·65 inches (corrected 29·49 inches.) I reached Chandbali about 1 P. M."

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* Correction of this barometer was found to be 0·16 inch.

The following is the description of the weather on board the *[illegible]* as kindly furnished by Mr. Ransom, Branch Pilot, who was on board:—

2 A. M.—Aneroid barometer 29 50 inches (corrected 29·31 inches), thermometer 82°. Fresh N.-W. breeze; heavy rainy appearance all round.

4 A. M.—Aneroid barometer 29·49 inches (corrected 29·30 inches); thermometer 82°; moderate W.-N.-W. breeze; passing rain squalls.

6 A. M —Aneroid barometer 29·46 inches (corrected 29·27 inches); threatening appearance all round, more especially to N.-W. and N. and N.-N.-E.; clearer and softer to southward

7-40 A M.—Weighed to proceed to sea. Aneroid barometer 29·50 inches (corrected 29·31 inches); thermometer 82°. Light N.-W. breeze. Rain.

9 A. M.—Passed Long Sand light. Increasing swell from S.-E.; moderate N.-W. breeze. Rain. Gloomy

9-45 A. M.—Upper Gasper light. Heavy breakers on Long Sand and increasing sea. Wind as before. Rain squalls apparently coming down from N. to N.-W.

10-25 A. M.—Lower Gasper light. Very wild appearance to westward; sea becoming breakers. Barometer 29·50 inches (corrected 29·31 inches); thermometer 82°.

11 A. M.—By this time the wind had hauled to W. and W.-S -W., each squall increasing in violence and the sea overwhelming the vessel. Lost a sea-cunny overboard (swept out of the lead platform). No possibility of saving his life in such a sea. Starboard cutter is smashed. A jolly boat injured; the decks full of water.

Noon.—Bell Buoy W.-S.-W., 1 mile. Steering S.-S.-W. to counteract the sea and set to leeward. Squalls most violent with a terrific sea. Could not see ¼ mile in any direction. Overhead it seemed as if the sun was shining, but after each squall the next appeared more violent.

2-30 P. M.—Sighted Eastern Channel light on the starboard bow. Aneroid barometer 29·52 inches (corrected 29·33 inches); thermometer 81°.

3 P. M —Passed Eastern Channel light and stood to the southward. Wind as before, but less violent, and as we got into deeper water the sea became more regular.

8 P. M.—Aneroid barometer 29·66 inches (corrected 29·47 inches); thermometer 84°. Shut up in saloon. Could not get the direction or force of wind. Less sea, but still taking in a great deal.

The ship *Champion* at noon was in the Eastern Channel At 6 A. M. a W.-N.-W. wind of force 6 was blowing, but from 8 A.M. she experienced W.-S.-W. winds of force ranging up to 10 and 11. The description of the weather is as follows: "Squally and rain with a dense dark blue ragged cloud bank from S.-E. to S.-S.-W. Continual dense rain and hard squalls with a very heavy confused sea." On the *Champion* the pressure registered at 8 A.M. of this day was 29·470 inches.

The observations made at the land stations in the neighbourhood of the storm may now be taken up, and most important amongst these are the observations at [illegible] which represents a [illegible] tion recorded at Saugor Island at 8 A.M. [illegible] only a slight local shift of wind, for W.-S.-W. and W. winds of moderate velocity had been blowing at Saugor Island since 2 A.M. in the morning, and at 9 A.M. again wind was westerly. The average force for the previous 24 hours had been only 4 miles an hour as recorded by the ordinary anemometer; while in the early morning the velocities had increased to about 16 miles an hour as registered by the Beckley's anemograph. In both cases, however, these numbers represent light winds only. At Calcutta at 8 A.M. pressure was 29·429 inches, or ·021 inch lower than at Saugor Island, while at 10 A.M. at Calcutta it was 29·419 inches, so that during this interval it was falling instead of rising as it ordinarily would have done. Also at Saugor Island at 10 A.M. pressure was 29·438, or 0·019 inch higher than at Calcutta. At 8 A.M. pressure at Calcutta was 0·135 inch lower than at the same time on the previous day; while at 10 A.M. the fall had increased to 0·146 inch. Wind at Calcutta at 8 A.M. was N.-E. and at 10 A.M. N.-N.-E., with an average velocity of 8 miles an hour. At Jessore, about 67 miles to the north-east of Calcutta, at 8 A.M. pressure was 29·469 inches, wind E. 12 miles an hour, and at 10 A.M. pressure was 29·462 inches, wind S.-E., velocity about 13 miles an hour. At Burrisal, considerably to the east of Saugor Island and Calcutta, at 8 A.M. pressure was 29·556 inches and wind S.-E., velocity 10 miles an hour.

These observations in themselves are sufficient to fix the position of the centre of the storm, which at 8 A.M. was about 25 miles to the south-east of Calcutta, if the wind directions are considered as defining the centre of the storm. In the 24 hours from 8 A.M. of the 22nd to 8 A.M. of the 23rd the storm centre had moved to the northward by about 40 miles. It was shown, however, that at 4 P.M. on the 22nd the storm centre had apparently retreated southwards to a small extent, and such being the case, and as it is not quite certain when the storm re-commenced its northerly advance, it is impossible to accurately estimate the velocity with which the storm was moving at this time.

The morning observations at the other inland stations call for few remarks. Winds showed a complete cyclonic circulation round the centre to the south-east of Calcutta, but in all cases winds were light, and the highest velocities recorded were about 13 and 14 miles an hour, and in many cases were much smaller. Pressure was falling moderately to rapidly, and the distribution of pressure was entirely governed by the existence of the storm. Heavy rain was falling over the area affected by the storm as is shown in the following statement. The rainfall in Orissa and in the Midnapore District of South-West Bengal was very heavy.

RAINFALL OF THE TWENTY-FOUR HOURS ENDING 6 P.M.

23rd August 1888.

Meteorological Division.	Average rainfall	HEAVY RAINFALLS EXCEEDING 3 INCHES.		
		District.	Station.	Amount.
	Inch.			Inches.
ORISSA	3·13	Pooree	False Point	5·35
		Cuttack	Jagatsingpore	3·88
			Cuttack	5·90
			Kendrapara	5·41
			Jajpore	3 87
			Dhurmsalla	4·00
		Balasore	Bhuddruck	4·03
			Sorah	4·25
			Balasore	5·11
			Jellasore	4·45
			Baripodah	3·10
S. W. BENGAL	0·81	Midnapore	Contai	6·33
			Saugor Island	4·11
			Heria	3·65
EAST BENGAL	1·36	Chittagong	Cox's Bazaar	5 91
			Chittagong	3·77
		Backergunge	Patuakhally	3·05
			Burrisal	3·25
			Bauphal	3·47
NORTH BENGAL	0·31	Darjeeling	Darjeeling	4·06
NORTH BEHAR	0·52	......	......	...
SOUTH BEHAR	0 38	......	......	...
CHUTIA NAGPUR	1·03	Singbhoom	Ghatsila	3·02

At 8 A.M. of this day the storm centre was, as already stated, about 25 miles to the south-east of Calcutta. Over the whole of the Province to the north, east and west of the storm centre, winds were light in force, though cyclonic in direction. Even at Saugor Island, about 50 or 60 miles to the south-west of the storm centre, winds continued light, and up to 10 A.M., over the sea area, the light-ships at the Lower Gasper, Intermediate and Ridge stations reported winds of force 4 to 6. The two pilot vessels, however, reported winds of force 9; while on the Mutla light-ship the winds were said to be of hurricane force (12). The position of the Mutla light-ship was about 90 miles almost due south of the storm centre as judged by the winds. The Intermediate light was about 80 miles S.-S.-E. of it, and the Ridge light about 130 miles in a S.-S.-E. direction. The strongest winds were, therefore, entirely confined to the south of the storm, and they did not appear to exist at any position, probably nearer than 80 or 90 miles from the centre, while also winds were lighter to the south-east and south-west than to the south of the storm. South of this, again, heavy weather generally prevailed to a distance of about 250 miles from the storm centre, as is shown by the logs of the various ships before given.

The automatic records of pressure and of wind direction and velocity taken at Calcutta (Alipore) Observatory, and the automatic records of wind and the frequent observations of pressure at Saugor Island, clearly show that the storm continued its slow northerly or north-westerly advance during the whole forenoon of this day, and these facts, with the 4 P.M. observations at the other stations given in the table, prove that at that time the storm centre was not more than a few miles, probably between 6 and 10 miles, to the south-east of Calcutta. At that period the wind velocity at Calcutta was only 4 to 6 miles an hour, while the pressure at 4 P.M. was 29·343 inches.

It is not intended here to give in detail the directions or force of the winds as recorded by the autographic instruments as they will be discussed in a separate section. It will there be seen that while at Calcutta close to the centre at 4 P.M. wind was so light as to be almost calm, and had been so during the whole of the advance of the storm towards this station, at Saugor Island strong winds were commencing to blow. From 8 A.M. to noon winds were light to moderate in force at that station, and from 10 A.M. to 12 they were W.-S.-W. in direction. From 12 to 2 P. M. wind gradually increased to a gale, the direction remaining the same, and from 3 P.M. (or soon after) a very severe W.-S.-W. gale set in, which lasted many hours. When, therefore, the gale set in at Saugor Island the centre of the storm, as judged by the wind directions, &c., was near Calcutta, or fully 80 miles to the N.-N.-E. of Saugor Island, thus corroborating the previous statement that the strong winds at this time did not exist nearer than about 75 or 80 miles to the south of the centre.

As judged by the wind directions the centre of the storm was almost directly to the east of Calcutta at about 7 P.M. of this date, when a pressure of 29·348 inches was recorded; but as will be seen in the section devoted to the discussion of the automatic records, pressure continued to fall at Calcutta (even after allowing for the changes due to the diurnal oscillation of the barometer) until 6 A.M of the 24th, or for no less than 11 hours after the storm centre, as indicated by the winds, had passed the station, and when the centre was at least 40 miles to the north of it.

On this day then the storm had only a small barometric depression equal to about a fifth of an inch below the normal of the day. It was travelling in a N. or N.-N.-W direction, at the rate of about 3 and a third miles an hour. It was attended by light to moderate winds over the whole of the inner area of about a diameter of 160 miles But about 80 miles to the south of the storm centre most furious winds were blowing, almost surpassing in the opinion of one competent observer the force of the wind in the fierce cyclones of 1885 (False Point cyclone in September 1885), and of 1887 (Balasore cyclone in May 1887). These fierce winds, however, were confined to the area south of the storm, though they extended to a considerable distance, probably to some 200 or 250 miles south of its centre. To the east and west of this area winds were of comparatively moderate force.

24th August 1888.—The principal meteorological data on which the discussion of the weather of this date depends, are included in the following table, which is divided into four sections, the first three dealing with the morning observations at the coast stations, on the ships navigating the Bay, and at the inland stations; while the fourth section deals with the 4 P.M. observations of the area over which the storm was travelling. The principal facts of pressure and wind direction with reference to the morning observations are charted on Plate XIV.

24th August 1888.

Hour.	Position of Station.	Station or Vessel.	Barometer.			Temperature.	Humidity.	Temperature previous 24 hours.		Wind.		Cloud proportion.	Rainfall.	Weather Remarks.
			Actual reduced to 32° and sea level.	Change since previous 24 hours.	Variation from normal.			Maximum.*	Minimum	Direction.	Velocity Miles per hour.			
A.M.	**A. Coast Stations.**													
9-30	Ceylon	Galle	30 018	+·032	?	82·5	85	85·0	80·0	N.-W.	4	3	*Nil.*	
9-30		Colombo	30·010	+·023	+·067	84·5	72	85·5	75·0	S.-S.-W.	9	4	*Nil.*	
9-30		Trincomalee	29·948	+·023	?	84·0	69	101·0	75·5	S.-W.	10	5	*Nil.*	
8	West Coast Bay.	Negapatam	29·919	+·014	+·073	81·9	82	88·5	78·8	S.-W.	4	8	*Nil.*	
8		Madras	29 913	+·017	+·065	81·0	80	89·0	76·5	S.-S.-W.	5	8	*Nil.*	
8		Cocanada	29·787	+·018	?	81·5	81	87·0	79·6	S.-W.	8	8	*Nil*	Smooth.
8		Vizagapatam	29·782	+·026	+·056	84·0	68	89·8	80·6	S.-W.	2	10	*Nil.*	
8		Gopalpur	29 710	+·027	+·023	79·0	91	80·2	77·8	S.-W.	16	10	0·23	Slight.
8		False Point	29·653	+·057	—·023	79·3	91	77·4	?	W.-S.-W.	20	10	2·15	
8		Balasore	29·602	+·080	?	77·0	93	78·3	74·8	S.-W.	16	10	5·28	
8		Saugor Island	29·541	+·097	—·096	76·9	93	80·7	74·5	S.-S.-W.	62	10	14 28	
8	East Coast Bay.	Chittagong	29·764	+·091	—·011	74·6	85	81·1	72·5	S.	6	10	6·75	
8		Akyab	29·601	+·039	+·028	81·1	91	84·7	77·1	S.-W.	4	10	1·38	
8		Diamond Island	29·925	+·019	+·098	81·4	85	80·4	70·6	S.-W.	8	3	1·	
8		Rangoon	29·932	—·011	+·094	77·6	96	80·1	75·9	S.-W.	?	10	0·03	
8		Tavoy	29 962	—·026	?	75·5	89	79·7	72·7	Calm	0	9	0·09	
10	Mid Bay	Port Blair	29·950	+·017	+·083	83·7	82	87·0	77·7	W.-S.-W.	5	5	*N*	Mist.
10		Nancowry	29·978	+·027	+·072	87·6	74	90·8	76·0	S.-W.	1	4	*Nil.*	Cloudy.

Hour.	**B. Sea Obervations.** Lat. N.	Long. E.	Station or Vessel.	Actual reduced to 32° and sea level.	Change since previous 24 hours.	Variation from normal.	Temperature.	Humidity.	Maximum.*	Minimum	Direction.	Velocity Miles per hour.	Cloud proportion.	Rainfall.	Weather Remarks.
A.M. 10	21°-2′	88°-46′	Mutla Light.	29·606	+·236	—·104	81·3	93	...	...	S.-W.	*8*f*	10	Amounts of rainfall not recorded.	Terrific cross sea.
10	21°-26′	88°-6′	Lower Gasper	29·510	+·189	—·180	79·9	9	...	...	S.-W.	6*f*	10		Heavy sea.
10	21°-14′	88°-11′	Intermediate.	29·634	+·189	—·066	81·7	86	...	...	S.-W.	7*f*	10		Sea very rough.
10	20°-46′	87°-39′	Ridge Light.	29·678	+·056	—·022	80·8	91	...	...	W.-S.-W.	5*f*	2		Sea very high.
8	...	...	P. V. *Coleroon*	29·527	+·137	—·173	...	..	...	...	S.-W.	6*f*	..		Overcast.
8	...	...	P. V. *Sarsuti*	29 618	+·150	—·082	..	..	...	...	S.-S.-W.	7*f*	...		Squally.
8	20°-57′	88°-11′	*Dundrennan*	29·567	?	—·133	...	..	...	...	S.-W. by W.	7*f*			
8	16°-15′	83°-28′	S.S. *Bancoora*	29·808	?	+·038	...	...	...	...	S.-W.	5*f*	.		
8	19°-30′	89°-33′	S. S. *Africa*	29·707	?	—·026	...	..	...	...	S.-W.	7*f*	...		Sea getting heavier.
8	21°-29′	88°-19′	*First Lancashire*	29·560	0	—·140	...	...	...	...	S.-W.	...	...		Torrents of rain.
8	20°-16′	87°-38′	S. S. *Clan Mackay.*	29·648	+·019	—·062	...	...	...	...	W.-S.-W.	5*f*	...		Overcast.
Noon	20°-13′	87°-00′	*Toxteth*	29·770	+·050	—·125	...	...	...	...	S.-W.	...	...		Strong gale.
”	20°-40′	88°-30′	*Skolfield*	29 560	+·130	?	...	...	...	...	S.-W.	7*f*	..		
”	19°-53′	88°-16′	*Desdemona*	29·720	—·010	+·030	...	...	...	...	Variable	...	...		Clear sky.
	Diamond	Harbour	S. S. *India*	29·510	—·010	—·173	...	...	...	...	S.-W.	10*f*	...		Heavy squalls.
A.M. 8	...	...	S. S. *Tibre*	29·581	—·084	?	...	.	...	...	W.-S.-W.	9*f*	...		
8	In Gasper	Channel	*Champion*	29·497	+·027	—·193	...	..	...	...	S.-W.	9*f*	...		Squalls less violent.
8	...	...	S. S. *Clan Macpherson*	29·609	—·018	?	...	...	...	...	S.-W.	8*f*	...		Heavy blinding squalls of rain.
8	21°-04′	87°-35′	S.S. *Euphrates*	29·629	?	—·071	...	...	...	...	S.-S.-W.	9*f*	...		

* In the column for the velocity of wind, numbers marked "*f*" represent wind force on Beaufort's scale 0-12.

24th August 1888—continued.

Hour.	Position of Station	Station or vessel.	Barometer.			Temperature.	Humidity.	Temperature previous 24 hours.		Wind.		Cloud proportion.	Rainfall.	Weather Remarks.*
			Actual reduced to 32° and sea level.	Change since previous 24 hours.	Variation from normal			Maximum.	Minimum.	Direction.	Velocity Miles per hour.			
A.M	C. INLAND STATIONS													
10	Assam	Sibsagar	29'782	+ 025	+'023	81 7	86	83 6	77 0	N.-E	2	10	0'12	
10		Silchar	29'771	+'041	+'003	80 6	87	85 4	75 8	S.-S.-W.	3	10	0 20	
10		Dhubri	29 669	— 037	047	82'1	78	85'2	77 8	E -S.-E.	21	9	0'09	
10	East Bengal	Dacca	29 612	+'013	'097	77 5	9	79'4	76 2	S.-S -E.	15	10	1'21	
10		Furreedpore	29 562	—'010	117	78 6	9	79 5	76 4	S.-S.-E.	14	10	0'19	
10		Jessore	29 441	— 021	-263	77'1	95	81 7	76 4	S.	14	10	0'57	
10	S.-W Bengal	Kishnaghur	29 354	— 149	'307	78'7	95	79'9	75 8	Calm.	12	10	0'41	
10		Saugor Island	29 585	+'147	—'117	78 9	93	80 7	74 5	S -S. W	50	10	15'13	
10		Calcutta	29 440	+'021	— 262	75 4	98	80 0	73 7	W.-S.-W	12	10	6 33	
10		Midnapore	29 565	+'059	— 219	75 6	91	77 3	75 3	S -W.	12	10	3'37	
10		Balasore	29 608	+ 080	— 056	77 5	93	76 3	74 8	S -W.	11	10	5'28	
10		Berhampore	29'420	—'130	— 284	79 3	91	81 1	75'3	N -E	16	10	0'24	
10		Burdwan	29 387	— 092	—'304	76 9	93	85 5	75 9	N.-N.-W.	9	10	0 85	
10		Bankoora	29 481	—'054	.	75 9	99	78 6	74'1	W -N.-W	10*	10	2'13	
10		Raneegunge	29 466	—'067	—'176	77 4	96	81'0	74'7	N -N.-W	11	10	1'21	
10	Behar	Purneah	29 601	—'050	— 077	84 6	72	87'7	73'1	E.	4	4	0 08	
10		Durbhunga	29 635	— 040	— 040	85'5	72	89 9	78 3	E.-N -E.	7	4	0'30	
10		Patna	29 648	—'013	— 031	85 1	74	87'4	76 2	E.	4	4	*Nil*	
10		Nya Doomka	29 013*	— 070	?	77'2	94	83 1	74 6	N -E	15	10	0'52	
10	Orissa	Cuttack	29 682	+ 0-9	—'005	80 0	78	78'3	75 8	W -S.-W	5	10	0'78	
10	Chutia Nagpur	Hazaribagh	29 617	— 023	— 069	75 0	94	79 4	71'7	N -E.	11	10	1'66	
10		Chybassa	29 596	+ 014	?	75'0	95	85 4	74'5	W	3	10	2'85	Overcast.
10	North Bengal	Maldah	29 469	— 067	?	78 1	91	89 3	75 9	N.-E.	13	10	0 09	
10		Bogra	29 558	— 057	?	76 6	97	*83 3	74 8	E.-N -E	14	10	0 52	
10		Rampore Bhaulea	29 482	—'109	— 176	79'2	90	81'8	74 6	E.	13	8	0 14	
P.M.	D. STATIONS NEAR STORM AREA.													
4	S. W. Bengal	Saugor Island	29'"24	+'142	—'063	79'2	91	80'8	74'7	S.-W.	52	10	6'28	Continuous rain
4		Calcutta	29'466	+'123	—'106	75'4	95	78'8	73'8	S.-W.	16	10	9'96	*o. g. p. q.*
4		Burdwan	29'333	—'016	—'227	77 0	93	85'7	75'9	N -N.-W	8	10	1'12	Gloomy, strong wind.
4		Berhampore	29'328	—'120	—'239	76'3	98	80'1	75'3	E.-N -E.	15	10	0'51	Overcast.
4		Jessore	29'368	+'001	—'208	79'1	86	79'5	76 2	S.-S.-W	13	10	0'49	Overcast.
4	East Bengal	Dacca	29'561	+'051	—'053	77 5	94	81 1	76 2	S.-S.-E.	14	10	1'17	Overcast.
4		Chittagong	29'682	+'035	+'013	79 7	92	80'9	71'8	S.-S.-E	7	10	6'92	Overcast.

* Not reduced to sea level.

At the coast stations round the Bay from Lat. 20° N. southwards, the pressure changes were small, a slight fall being reported at some of the eastern stations and a slight rise along the west coast. South-westerly winds of moderate to considerable strength were also reported, but the indications were such as usually accompany strong south-west monsoon conditions.

Over the sea area several vessels were navigating the Bay in various positions between Lat. 10° and 15° N. These were the *Nerbudda*, *City of Edinburgh*, *County of Selkirk* and *Engineer*, the observations of which are dis shown in the table, as they merely indicate the prevalence of marked south-west monsoon conditions in the Bay. Thus the *Nerbudda* reports S.-W. winds of force 4, the *City of Edinburgh* S.-S.-W. winds of force 5—6, the *County of Selkirk* S.-W. winds of force 5, and the *Engineer*, which was the furthest to the north S.-W. winds of force 6. She also reported during the day hard squalls from west, and in the evening squalls of short duration, and strong breeze, but fine weather. It will be here seen that winds gradually increased in force from south to north, and that in Lat. 15° N. strong winds were blowing.

From Lat. 15° to 20° N., the following vessels were in the order named from south to north—the *Bankoora*, *Culna*, *Africa*, and *Desdemona*—the *Bankoora* being in the west of the Bay and the others more in the centre. The *Bankoora* had S -W. winds of force 5 to 6, the *Culna* in Lat. 17° 45′ N., S. winds of force 5; and the *Africa* in Lat. 19° 30′ N. and Long. 89° 33′ E. had S.-W. winds of force 8—10. The description of weather given in her log is—"Heavy squalls, dense black clouds, sea getting heavier. Tremendously heavy squalls, raining in torrents, gradually lessening at 4 P.M. Very heavy rolling sea. Blowing heavily." On the *Desdemona* which was nearer the head of the Bay, being in Lat. 19° 53′ N. and Long. 88° 16′ E., south-westerly and S.-S.-W. winds of force 9 with a strong gale, high sea with heavy rain and occasional clear sky were experienced.

At the coast stations round the head of the Bay to the north of Lat. 20° N. strong winds were blowing. From Saugor Island westward winds were S.-S.-W. and S.-W., and east of Saugor Island they were generally southerly. At such stations as False Point on the one side and Chittagong on the other, which were considerably removed from the central track of the storm, winds were of moderate strength: at False Point the velocity averaged 20 miles, and at Chittagong 6 miles an hour. At Saugor Island, however, which was close to the central track of the storm, the wind velocity recorded by the ordinary anemometer had risen to the very large amount of 62 miles an hour, and for the 24 hours ending 8 A.M. of the 24th the velocity averaged 50 miles an hour, which is an extremely severe gale of wind. Pressure was rising moderately to rapidly, the rise at most stations only equalling about a twentieth of an inch, while at Saugor Island it equalled about a tenth. Unusually heavy rainfall had accompanied the storm, and at Saugor Island 14·28 inches had fallen from 8 A M. of the 23rd to 8 A M. of the 24th; Chittagong had received 6·75 inches, and Balasore 5·28 inches.

Over the sea area north of Lat. 20° N. observations were obtained from the four light-ships, the two pilot brigs, and the following vessels, their positions being given from the most southern towards the north. They were the *Toxteth*, *Clan Mackay*, *Skolfield*, *Dundrennan*, *Euphrates*, and *First Lancashire*, while the *Clan Macpherson* and *Tibre* were near the pilot station and were looking for the pilot brigs; the *Ooriya* was proceeding towards Chandbali, the *Loodiana* was heading towards Madras, and the *Champion* was in the Gasper Channel.

Over the whole of this area, pressure was rising rapidly, and in several cases the increase was from a tenth to a fifth of an inch. Winds were in almost every instance S.-W., though they were W.-S.-W. and S.-S.-W. in a few cases. The following statements show the wind force and kind of weather experienced by these vessels at this time: The *Toxteth* reported a strong to a hard gale of wind with violent squally weather attended with very heavy rain. The *Clan Mackay* experienced winds of force 7 in the morning, moderating to force 4 in the evening, with heavy squalls in the morning, and moderating later on during the day. The *Sholfield*, which was rather more to the east than most of the other vessels, being in Lat. 20° 40′ N. and Long. 88° 30′ E., reports that the day began with a furious gale, rain falling in torrents. In the middle and latter part of the day it was much more moderate, with heavy squalls and a strong current to the eastward, and afterwards cleared a little; the force of wind at noon was equal to 7. The *Dundrennan*, in Lat. 20° 57′ N. and Long. 88° 11′ E., had winds of force 8 in the morning, moderating to 6 in the evening, and reported the weather as "in the morning fierce squalls and rain. Noon—Fresh gale." The *Euphrates* was a little further north in Lat. 21° 4′ N. and Long. 87° 35′ E., and had winds of force 9 throughout the day. The weather she experienced was as follows:—"4 A.M.—Heavy gale with very high sea. Noon—Very heavy squalls with much rain. 8 P.M.—Strong gale but clearer, and squalls less frequent. Sea very high." The *First Lancashire* was in Lat. 21° 29′ N. and Long. 88° 19′ E., and was therefore very close to the land. The force of the wind experienced is not given, but the description of the weather is as follows: "Strong gale from S.-W. attended with terrific squalls and torrents of rain, with high confused sea in the morning and hard gale and very violent squalls at times with torrents of rain in the evening." The *Clan Macpherson* which was near the pilot station reported at 4 A.M. S.-W. winds of force 9, decreasing later on to force 7. She experienced "heavy blinding squalls of rain till daylight (of the 25th), when it cleared with moderate squalls at longer intervals. The sky was full of grey dull dense clouds till noon, when it broke overhead and remained mostly clouded with a grey motionless bank, beneath which were driving clouds and squalls." The *Tibre* was also near the pilot station She had winds of force 9 in the morning decreasing to force 4 at midnight. The *Ooriya*, which was on her voyage towards Chandbali, stood to the westward from midnight of the 23rd, and at 3 A.M. of the 24th the rain ceased, but the wind held on very strongly from the S.-W. By daylight on Friday morning (24th) she was about 15 miles south of the Ridge light-ship, and the weather was of ordinary monsoon character. The *Ooriya* reached Chandbali at 1 P.M., and during the whole of the 24th there was a strong S.-W. wind, but no rain. The *Loodiana* during the whole of the 23rd had continued to steam southwards, and had run about 90 miles only in the 24 hours, and on the evening of the 24th she ran out of the reach of the storm, though there was still a heavy sea with a fresh S.-W. monsoon blowing. The *Champion* was in the Gasper Channel, and in the early morning experienced S.-W. winds of force 10 with high sea and heavy squalls and rain. Weather, however, gradually moderated, and by the evening winds were of force 7, though it was still squally with much rain. On the pilot vessel *Coleroon* wind in the early morning was W.-S.-W. and of force 8, decreasing to 6 in the evening. During the day she experienced a very high sea. The *Sarsuti* reported S.-W. winds of force 7 to 8 in the middle of the day, decreasing to force 5 at midnight. At 8 P.M. it was still blowing freshly with a moderate sea, but the appearance was becoming finer.

On board the *Meteor* at the Ridge Light station wind was W.-S.-W. of force 5, with a high sea. On the *Planet* (Intermediate station) winds were from S.-W. in the forenoon and of force 7, and W.-S.-W. in the afternoon of force 6, with very rough sea. On the *Canopus* (Mutla station) "from 6 A.M. the wind and sea began to abate in force, but it remained blowing a hard gale up to 4 P.M. From that time to midnight the wind fell to a moderate gale, but still with passing rain-squalls, the very heavy confused sea going down faster than the wind." The wind direction remained steady at S.-W., and at 10 A.M. its force was 8, while at 4 P.M. it was 7. On the *Hesperus* at the Upper Gasper station wind also remained at S.-W. throughout the day and of force from 6—7. Sea was heavy, and there were heavy squalls of wind and rain, and wind was blowing with hurricane force during the night.

An exceedingly rapid fall of pressure had taken place at such stations as Kishnaghur and Berhampore, while pressure was falling less rapidly at the other stations in the centre of Bengal. At Calcutta, Midnapore, &c., pressure was rising rather briskly. The lowest pressure recorded on the morning of this day was 29 354 inches at Kishnaghur, where wind was calm at the time of observation (*i.e*, 10 A.M), though an average velocity of 12 miles for the previous 24 hours had been recorded. At Burdwan pressure was 29·387 inches, with wind N.-N.-W., velocity 9 miles an hour. At Bankoora pressure was 29·481 inches, with wind W.-N.-W., velocity 10 miles an hour. At Calcutta pressure was 29·440 inches, with wind W.-S.-W., velocity during the previous 24 hours 12 miles an hour; and at Jessore pressure was 29·441 inches, wind S., velocity 14 miles an hour. It is clear from these observations that at 10 A.M. of the 24th the centre of the storm was almost over Kishnaghur, and that on this day the pressure at the centre of the depression was not much below 29·35 inches. The storm centre had therefore travelled from its position at 4 P.M. on the 23rd which was about 6 to 10 miles to the south-east of Calcutta to near Kishnaghur at 10 A.M. of the 24th, or over about 60 miles in a direction which was a little to the west of north. The average rate at which the storm was moving forward on this day was therefore about three and a-third miles an hour, which is a decidedly slow rate of progress for a cyclonic storm.

As will be seen by the figures previously given of the wind velocities at the stations surrounding the centre of the storm, winds continued light to the north, east and west of the storm centre, and even at Calcutta on the south the average wind velocity for the previous 24 hours was not high. Indeed, winds were stronger at many of the stations far removed from the actual storm than they were near the centre. Thus Dhubri on this day registered a wind velocity of 21 miles an hour, Maldah and Bogra velocities of 13 and 14 miles an hour, and Dacca 15 miles an hour. The continuous record of wind velocity at Calcutta, however, enables the exact time at which winds commenced to strengthen at this station to be determined. On the early morning of the 24th at Calcutta up to 1 A.M. wind was almost calm (velocity about 2 miles an hour). It then commenced slowly to increase, and between 3 and 4 A.M. it blew at the rate of about 18 miles an hour, and steadily strengthened until the average velocity of 34 miles an hour was recorded between 7 and 8 A.M. Taking the time at which strong winds commenced at Calcutta to be about 4 A.M., the centre of the storm at that time was about 35 miles to the north of Calcutta. On the previous two days the position of stormy winds was found to be 80 to 90 miles from the centre; but as the storm advanced inland the area of strong winds closed up towards the centre, and certainly came on this day to within half the previous distance from it. The explanation of this fact is at first sight difficult, for the storm had certainly not increased in intensity to any material extent during the previous two days as judged by the barometric differences, wind velocities, &c. From the position, about 35 miles to the south of the centre, the area of stormy winds certainly extended to about Lat. 19° N. 20° N., or to a distance of about 200 to 250 miles from the storm centre.

The observations taken at 4 P.M. on the 24th, given in the fourth section of the table of meteorological data for the day, show the steady advance of the storm centre. It was apparently at that hour some little distance to the north-west of Kishnaghur, and appears to have passed a little distance to the west of that station, but as the number of 4 P.M. observations taken in Bengal is small, it is not possible to determine accurately the position of the storm centre at that hour.

The rainfall reported was again decidedly heavy on the 24th August, and in South-West Bengal an average fall of no less than 3·75 inches was recorded, while in Orissa it averaged 1·77 inches, and in East Bengal 1·94 inches. The falls in South-West Bengal in excess of 5 inches were very numerous, and several stations recorded more than 10 inches. The heaviest falls were—Oolooberiah 15·42 inches, Dum Dum 12·36 inches, Howrah 11·66 inches, Saugor Island 11·14 inches, and Calcutta (Alipore) 10·19 inches. The more important data are given in the following table:—

RAINFALL FOR THE TWENTY-FOUR HOURS ENDING 6 P M.

24th August 1888:

Meteorological Division	Average rainfall	Heavy rainfalls exceeding 3 inches.		
		District	Station.	Amount.
	Inch.			Inches.
ORISSA . . .	1·77	Cuttack . . .	Jagatsingpore . . .	5·00
			Jajpur . . .	4·04
			Salipore . . .	6·18
		Balasore . . .	Baripodah . . .	3·50
S. W. BENGAL .	3·75	Midnapore . . .	Contai . . .	7·92
			Saugor Island . .	11·14
			Tamlook . . .	8·30
			Midnapore . . .	5·54
			Kukrahaty . . .	8·20
			Heria . . .	6·92
			Garbeta . . .	7·52

24th August 1888—continued.

Meteorological Division.	Average rainfall.	Heavy rainfalls exceeding 3 inches.		
		District.	Station.	Amount.
	Inch.			Inches.
S. W. Bengal	3·75	24-Pergunnahs	Diamond Harbour	7·10
			Canning Town	6·01
			Alipore Jail	10·19
			Barrackpore	5·30
			Dum-Dum	12·36
			Baraset	8·50
			Busseerhat	3·28
		Howrah	Howrah	11·66
			Mohesreka (Oolooberiah)	15·42
		Hooghly	Serampore	8·44
			Hooghly	5·81
			Jehanabad	6·95
		Bankoora	Bishenpore	4·72
			Khatra	4·30
			Kotalpore	3·42
			Anda	3·12
			Raipur	6·15
		Nuddea	Ranaghat	4·32
			Kishnaghur	4·55
East Bengal	1·94	Chittagong	Chittagong	6·91
			Kutubdia	3·25
		Chittagong Hill Tracts	Rangamati	3·54
		Backergunge	Patuakhally	5·41
			Bhola	3·04
			Bauphal	4·72
		Noakholly	Fenny	3·75
			Harishpur	5·25
			Ramganj	3·60
		Tipperah	Laksham	3·86
North Bengal	0·27	......	......	...
North Behar	0·18	......	......	...
South Behar	0·47	......	......	...
Chutia Nagpur	1·23	Singbhoom	Ghatsila	3·05
		Manbhoom	Barrabhoom	3·70

25th August 1888.—The meteorological data on which the discussion of the weather of the 25th depends are contained in the three sections of the following table, the first of which deals with the morning observations at the coast stations, the second with those taken on board certain vessels navigating the Bay, and the third at the inland stations. The principal facts as to pressure and wind direction of the observations taken in the forenoon are given on Plate XV.

25th August 1888.

Hour.	Position of Station.	Station or Vessel.	Barometer.			Temperature.	Humidity.	Temperature previous 24 hours		Wind.				
			Actual reduced to 32° and sea level	Change since previous 24 hours.*	Variation from normal.			Maximum.	Minimum.	Direction.	Velocity. Miles per hour.	Cloud proportion.	Rainfall.	Weather Remarks.
A.M.	A. Coast Stations.													
9-30	Ceylon	Galle	30·030	+·012	?	87·5	86	85·0	80·5	N.-W.	6	2	*Nil.*	
9-30		Colombo	30·025	+·015	+·093	85·5	70	87·0	76·0	S.-W.	11	2	0·01	
9-30		Trincomalee	29·957	+·009	?	87·5	67	99·5	71·5	S.-W.	4	2	*Nil.*	
8	West Coast Bay	Negapatam	29·921	+·002	+·098	83·4	78	89·0	78·8	S.-W.	6	5	*Nil.*	
8		Madras	29·924	+·011	+·095	82·5	77	90·0	76·5	S.-W.	7	7	*Nil.*	
8		Cocanada	29·815	+·028	?	81·0	85	88·5	78·6	W.-S. W.	10	10	0·63	Sea smooth.
8		Vizagapatam	29·813	+·031	+·090	83·5	75	89·3	79·6	W.	2	5	*Nil.*	
8		Gopalpur	29·721	+·011	+·064	80·5	91	82·2	78·8	S.-S.-W.	25	2	*Nil.*	
8		False Point	29·722	+·069	+·044	80·8	85	79·4	75·6	S.-S.-W.	18	10	0·04	
8		Balasore	29·693	+·091	?	78·5	98	79·4	75·7	S.-S.-W.	14	10	0·46	
8		Saugor Island	29·660	+·119	+·003	79·9	93	80·7	78·5	S.-S.-W.	36	10	1·24	Sea rough.
8	East Coast Bay	Chittagong	29·800	+·036	+·052	79·2	90	81·1	?	S.-E.	4	7	2·45	
8		Akyab	29·872	+·071	+·075	80·1	91	85·2	80·1	S.-W.	4	10	0·13	
8		Diamond Island	29·953	+·028	+·110	80·9	87	80·4	70·6	S.-W.	6	4	*Nil.*	
8		Rangoon	29·971	+·039	+·124	77·6	96	81·6	73·4	S.-S.-W.	?	8	0·70	
8		Tavoy	29·983	+·021	?	74·5	94	82·7	72·2	W.	2	9	0·54	
10	Mid Bay	Port Blair	29·981	+·031	+·121	85·2	78	87·5	77·9	W.-S.-W.	5	4	*Nil.*	
10		Nancowry	29·984	+·006	+·083	86·4	74	93·6	77·0	S.-W.	1	6	0·08	
	B. Sea Observations.													
A.M.	Lat. N. Long. E.													
10	21°-2′ 88°-46′	Mutla Light	29·734	+·128	+·024	81·3	93	...	...	S.-W.	6*f*	10	Amounts of rainfall not recorded.	Continuous squalls.
10	21°-26′ 88°-6′	Lower Gasper	29·597	+·087	— 093	80·9	91	...	...	S.-W.	6*f*	[illegible]		Moderate sea.
10	21°-14″ 88°-11′	Intermediate	29·709	+·075	+·009	81·7	86	...	...	S.-W.	7*f*	10		Sea very rough.
10	20°-46′ 87°-39′	Ridge Light	29·716	+·038	+·016	81·3	87	...	...	W.-S.-W.	5*f*	2		Stormy.
8	... ...	P. V. *Coleroon*	29·703	+·099	+·003	...	...	...	...	S.-W. by W.	6*f*	...		Cloudy.
8	... ...	P. V. *Sarsuti*	29·689	+·071	—·011	...	...	...	...	S.-W.	5*f*	...		
Noon	21°-18′ 88°-24′	*Dundrennan*	29·634	0	—·052	...	...	...	...	S.-W.	6*f*	...		Heavy rain.
A.M. 8	Off Pilot Ridge.	*First Lancashire*	29·560	0	—·140	...	...	...	...	...	...	...		Hard gale.
8	Lower Ridge Buoy	*S. S. Clan Mackay*	29·663	+·019	—·033	...	...	...	...	W.-S.-W.	5*f*	...		
Noon	20°-30′ 87°-33′	*Desdemona*	29·780	+·060	+·033	...	...	...	...	...	...	...		

* In the column for the velocity of wind, numbers marked "*f*" represent wind force on Beaufort's scale 0-12.

25th August 1888—continued.

Hour.	Position of Station.	Station or Vessel.	Barometer.			Temperature.	Humidity.	Temperature previous 24 hours.		Wind.		Cloud proportion.	Rainfall.	Weather Remarks
			Actual reduced to 32° and sea level.	Change since previous 24 hours.	Variation from normal.			Maximum.	Minimum.	Direction.	Velocity. Miles per hour.			
A.M.	C. INLAND STATIONS.													
10	Orissa	Cuttack	29·745	+·063	−·006	82·5	93	82·8	77·9	S.-S.-W.	5	10	0·05	
10	S. W. Bengal	Midnapore	29·682	+·117	+·003	79·5	91	76·2	74·3	S.	12	8	4·80	
10		Calcutta	29·672	+·232	−·039	80·4	87	79·0	75·2	S.-W	21	10	4·75	
10		Burdwan	29·599	+·212	−·102	80·4	82	85·5	76·4	S.	7	10	0·75	
10		Bankoora	29·591	+·112	?	80·9	85	81·6	74·6	W.-S. W.	11	9	1·64	
10		Raneegunge	29·534	+·068	−·106	79·4	86	80·5	74·9	S.-W.	12	9	0·71	
10		Berhampore	29·596	+·176	−·116	78·3	95	80·1	75·3	S.	13	10	1·48	
10		Kishnaghur	29·656	+·302	+·019	80·7	83	81·4	76·8	S.	18	9	4·58	
10		Jessore	29·676	+·235	−·038	79·5	94	79·7	74·9	S.	9	10	1·17	
10	East Bengal	Furreedpore	29·698	+·136	+·026	78·6	98	80·6	75·4	S.-S.-E.	14	10	1·80	
10		Dacca	29·714	+·102	−·004	79·5	91	81·1	76·7	S.-S.-E.	12	10	2·61	
10		Burrisal	29·744	+·127	+·056	76·7	95	81·3	72·9	S.	12	10	1·88	Rainy.
10		Mymensingh	29·733	+·085	+·039	77·2	98	77·9	75·1	E.-S.-E.	12	6	1·70	
10		Chittagong	29·826	+·070	+·061	80·7	88	81·1	74·0	S.-S.-E.	6	10	2·28	g.
10		Comillah	29·756	+·051	+·061	77·7	95	78·9	70·8	S.-E.	10	9	3·21	
10	North Bengal	Bogra	29·648	+·090	?	76·6	96	79·8	74·3	E.-S.-E.	11	10	4·39	
10		Serajgunj	29·683	+·123	+·002	76·6	98	81·7	74·7	S.	10	10	2·54	
10		Rampore Bauleah.	29·618	+·136	−·037	79·6	91	79·9	76·6	S.-E.	14	8	1·51	
10		Dinagepore	29·661	+·064	−·002	76·2	95	84·6	74·6	E.	22	10	0·81	
10		Rungpore	29·689	+·053	−·007	74·8	95	86·8	74·7	E.	14	8	1·02	
10		Jalpaiguri	29·709	+·078	+·027	75·5	92	89·0	74·8	E.	18	10	0·05	
10		Darjeeling	22·934	+·004	0	57·0	100	66·6	51·1	N.-E.	12	10	3·85	
10	Behar	Purneah	29·618	+·017	−·062	77·6	95	87·7	71·6	N.-E.	8	8	0·51	
10		Durbhunga	29·707	+·072	+·025	77·4	86	88·9	77·3	N.-E.	10	10	0·19	
10		Motiharee	29·703	+·052	+·064	81·6	73	85·7	75·9	E.-N.-E.	6	10	0·70	
10		Chupra	29·719	+·074	+·086	80·1	78	80·5	77·1	E.	5	9	*Nil*	
10		Bhagalpur	29·559	−·028	−·094	76·4	95	85·3	75·0	E.	16	10	1·04	
10		Nya Doomka	28·959*	−·054	?	75·7	97	79·8	74·2	S.-S.-W.	14	10	3·02	
10		Patna	29·703	+·055	+·013	77·0	91	88·4	77·2	E.	4	10	0·06	
10		Arrah	29·698	+·049	+·064	80·7	79	88·9	77·1	E.	4	10	0·01	
10		Buxar	29·708	+·053	+·068	84·5	72	88·4	78·2	E.-N.-E.	6	8	*Nil*	
10		Dehree	29·699	+·057	+·047	82·9	85	86·8	76·5	E.-N.-E.	9	6	0·02	
10		Gya	29·657	+·035	−·031	83·2	75	86·9	75·8	Calm	3	10	0·43	
10	Chutia Nagpur	Hazaribagh	29·671	+·054	−·032	73·0	95	78·9	70·7	N.-W.	15	10	0·38	
10		Ranchee	29·669	+·061	+·004	75·2	86	80·5	70·4	W.-N. W.	10	10	0·36	

* Not reduced to sea level.

The weather conditions over the Bay from Lat. 20° N. southwards call for few remarks. A considerable number of vessels were navigating the Bay. Weather was generally of rather strong south-west monsoon character, but was not at all stormy. Thus the *Nerbudda* in Lat. 14° 52′ N. and Long. 83° 10′ E. reported S.-W. winds of force 4 with cloudy weather. The *City of Edinburgh* in Lat. 16° 3′ N. and Long. 86° 11′ E. had S.-W. winds of force 6, and reported generally fine weather, but also observed a "heavy bank of clouds on the northern horizon high up and distinctly outlined," which was evidently the storm retreating to the north over the land. The *Bangora* in Lat. 19° N. and Long. 86° 37′ E. reported S.-S.-W. winds, usually of force 6.

At the coast stations round the Bay south of Lat. 20° N., the meteorological observations also showed that weather was of ordinary monsoon character. Pressure had generally risen by small amounts and winds were south-westerly in direction, and the velocities ranged from about 6 to 10 miles an hour. North of Lat. 20° N. conditions were still disturbed from the effects of the storm, but the excessively stormy weather of the previous day had practically disappeared. The following are some descriptions of the weather between Lat. 20° N. and the South Bengal Coast. The *First Lancashire* was at the Pilot Ridge, and experienced a strong gale of wind, and took on board large quantities of water. The *Clan Mackay* was in about same position, but only reported W.-S.-W. winds of force 5 to 6, and cloudy weather with rain-squalls. The *Dundrennan* was in Lat. 20° 30′ N. and Long. 87° 53′ E. and had S.-S.-W. winds of force 7 to 8, and reported "clear weather with showers, sea going down." The *Toxteth* reported a strong W.-S.-W. breeze with threatening squally weather. The *Skolfield* was coming in towards Saugor Island which she reached at 2·30 P.M., and experienced S.-W. winds of force 6 and squally weather, but later on it became clear and fine. The *Euphrates*, *Champion*, and *Africa* were all coming up the river and experienced similar weather, except that as the day progressed weather moderated, and the force of the S.-W. winds, which still continued, fell to about 3 to 5. In no case, therefore, was the wind force above 8 over this area on the 25th, and this only for a short time in the morning, and nothing beyond an ordinary gale of wind was reported over the greater part of this sea area during the early part of the day, while towards the night weather was practically of ordinary monsoon character.

The observations made at the coast stations round the head of the Bay point to similar conclusions. Pressure was rising rapidly, particularly at Saugor Island and Balasore. Moderately strong S.-W. winds were blowing at such stations as False Point and Gopalpur on the one side, and light southerly (from S.-E. to S.-W.) winds at the eastern stations in the Bay. At Saugor Island, however, strong winds continued to blow, and the velocity from 8 A.M. of the 24th to 8 A.M. of the 25th averaged 36 miles an hour, and during the greater part of this day strong winds continued to be reported, but the wind force was by no means so high as on the previous day, and only indicated an ordinary gale.

From the observations taken at the inland stations given in section C of the table for this day, it will be seen that the storm had again advanced, the direction of its advance being N.-W. or rather more westerly than it had been on the previous day. Pressure had risen extremely rapidly at such stations as Kishnaghur, Jessore, Calcutta, Burdwan, &c., the rise being largest at Kishnaghur, where from 10 A.M. of the 24th to the same hour of the 25th, the rise equalled 0·302 inch. Pressure on the other hand had fallen rapidly at Nya Doomka, where the fall equalled 0·064 inch, and moderately at Bhagalpur where the fall was 0·028 inch, and it was also low and below the normal of the day at such stations as Gya and Hazaribagh. The lowest pressure in the Province was probably at Nya Doomka, where the reading, *uncorrected* for elevation, was 28·959 inches, which would roughly be equivalent to about 29·46 inches at sea level, but the exact value cannot be given as the elevation of Nya Doomka has not been ascertained. Also wind, which had been N.-E. on the 24th, had changed to S.-S.-W. on the 25th, and the wind velocity for the previous 24 hours averaged 14 miles an hour. Next to this the lowest pressure was reported from Raneegunge, where it equalled 29·534 inches and where wind was S.-W., velocity 12 miles an hour. At Bhagalpur pressure was 29·559 inches, wind E., velocity 16 miles an hour. At Berhampore pressure was 29·596 inches, wind S., velocity 13 miles an hour. At Bankoora pressure was 29·591 inches, wind W.-S.-W., velocity 11 miles an hour. At other stations pressure was much higher. The following give the wind directions at those stations which show the position of the storm on this day. At Dehree wind was E.-N.-E., velocity 9 miles; at Hazaribagh wind was N.-W., velocity 15 miles; and at Ranchee wind was W.-N.-W., velocity 10 miles an hour. These observations are sufficient to fix the position of the storm, the centre of which does not appear to have been close to any meteorological observatory. It was nearest to Nya Doomka in the Sonthal Pergunnahs, and at 10 A.M. the centre was probably 20 or 25 miles in a W.-N.-W. or N.-W. direction from that station.

The storm had, therefore, moved almost in a north-westerly direction since 10 A.M. of the 24th, and the distance over which it had travelled appears to have been about 130 miles, that is, the velocity was about five and-a-half miles an hour, or considerably greater than on the previous day, when the velocity was three and-a-third miles.

It is almost impossible to state over what area strong winds obtained on this day. So far as can be judged, though the depression at the centre had probably not decreased, yet the winds were generally not so strong as they had been previously, and except just at the head of the Bay they scarcely amounted in force to a gale. It must, however, be remembered that the centre of the storm was now about 220 miles inland, that moderately strong winds were blowing over the whole of the area to the south of the centre, and that at the head of the Bay, about 250 miles from the centre, winds of force 8 were reported.

The rainfall of this day was very heavy. The average fall in South-West Bengal was 1·74 inches, in East Bengal 1·96 inches, and in North Bengal and North Behar between 1 and 2 inches. Falls exceeding 3 inches were also numerous, as will be seen by the figures included in the following table:—

RAINFALL FOR THE TWENTY-FOUR HOURS ENDING 6 P.M.

25th August 1888.

Meteorological Division.	Average rainfall	Heavy rainfalls exceeding 3 inches		
		District.	Station.	Amount.
	Inch.			Inches.
Orissa . . .	0·21	......	... ...	...
S.-W. Bengal . .	1·74	24-Pergunnahs .	Diamond-Harbour .	5·74
			Barrackpore . .	4·50
		Hooghly . . .	Hooghly . . .	3·62
		Burdwan . . .	Culna . . .	5·60
		Bankoora . . .	Kotalpore . . .	3·70
		Beerbhoom . .	Bolpur . . .	3·02
		Nuddea . . .	Ranaghat . . .	3·08
			Chooadanga . .	6·25
			Meherpore . . .	3·68

25th August 1888—continued.

Meteorological Division.	Average rainfall.	Heavy rainfalls exceeding 3 inches.		
		District.	Station.	Amount.
	Inch.			Inches.
East Bengal . .	1'96	Backergunge . .	Bauphal . . .	3'14
		Noakholly . .	Noakholly . . .	3'15
			Harishpore . . .	3'28
			Ramganj . . .	3'20
		Furreedpore .	Goalundo . . .	4'20
		Mymensingh . .	Subornakhally .	4'92
			Dewanganj . . .	3'30
North Bengal . .	1'44	Pubna . . .	Serajgunj . . .	3'05
		Bogra . . .	Sherpore . .	4'75
			Nowkhilla . . .	3'05
			Bogra	4'30
		Rungpore . . .	Bhowanigunge . .	3'25
		Darjeeling . .	Darjeeling . . .	4'20
North Behar . .	0'39	Monghyr . .	Beguserai . . .	3'25
South Behar . .	1'46		Jamui	3'40
			Sheikpura . . .	4'03
		S. Bhagalpur . .	Banka . . .	3'02
		Sonthal Pergunnahs .	Rajmehal . . .	3'33
			Pakour . . .	3'04
			Deoghur . .	5'35
Chutia Nagpur .	0'88	Hazaribagh . .	Pachamba (Giridi) .	3'72
			Karagdeha . . .	5'40

26th August 1888.—It has already been shown that on the evening of the 25th August weather had become of ordinary monsoon character over the whole of the Bay of Bengal, and it is therefore not necessary to discuss for this or future days any meteorological observations except those over the land. The following table therefore contains one section only instead of three or four, that is, only the 10 A.M. observations made at the stations in Bengal. As in former cases, the facts with reference to barometric pressures and wind directions are charted on Plate XV, but on this day the chart only deals with the land area of the Province of Bengal and the neighbouring districts:—

26th August 1888.

Hour.	Position of Station.	STATION.	BAROMETER.			Temperature.	Humidity.	TEMPERATURE PREVIOUS 24 HOURS.		WIND.		Cloud proportion.	Rainfall.	WEATHER REMARKS.
			Actual reduced to 32° and sea level.	Change since previous 24 hours.	Variation from normal.			Maximum.	Minimum.	Direction.	Velocity. Miles per hour.			
A.M														
10	Orissa	Gopalpur	29·762	+·00	+·067	81·5	87	83·2	78·8	S.-S. W.	21	5	0·07	
8		Pooree	29·753	+·03	?	79·6	93	82·2	?	S.-W.	16	8	0·08	
10		False Point	29·747	—·001	+·031	83·3	83	83·9	76·1	S.-W.	18	9	*Nil.*	
10		Cuttack	29·760	+·015	+·061	85·5	72	87·9	75·8	W.-S. W.	6	8	0·26	
10	S. W. Bengal	Balasore	29·720	+·008	+·063	81·5	93	86·4	77·7	S.	11	10	0·05	
10		Midnapore	29·709	+·027	+·025	82·5	87	87·3	76 8	S.	8	3	*Nil.*	
10		Saugor Island	29·711	+·013	—·007	84·9	83	83·7	79·0	S -S.-W.	32	7	*Nil.*	
10		Calcutta	29·722	+·05	0	82·4	83	83·0	78·7	S.-W.	13	6	0·03	
10		Burdwan	29·661	+·062	—·053	82·4	81	85·0	78·9	S	7	10	0·92	
10		Bankoora	29·652	+·061	?	82·4	80	86·6	78·5	S.-W.	9	8	0·27	
10		Raneegunge	29·594	+·060	—·049	84·9	79	83·0	74·9	S -W.	12	10	0·22	
10		Berhampore	29·660	+·064	—·063	83·3	83	83 1	75·3	S.-S.-E.	8	10	1·46	
10		Kishnaghur	29·704	+·048	+·029	84·7	79	85·9	78·2	S.	14	5	*Nil.*	
10		Jessore	29·731	+·055	+·006	84·9	79	82·2	79·4	S.	6	8	1 00	
10	East Bengal	Furreedpore	29·749	+·051	+·072	82·6	87	83·0	76·4	S.-S -E.	9	5	0·80	
10		Dacca	29·748	+·03	+·021	83·6	86	81·1	76·2	S.	9	8	0·34	
10		Burrisal	29·767	+·023	+·082	81·7	91	81·3	76·4	S.	8	10	0·36	
10		Mymensingh	29·755	+·022	+·060	82 2	87	83·4	76·6	S.-E.	9	10	0·31	
10		Chittagong	29·823	— 003	+·053	83·2	86	82·1	75·5	S -S.-E.	6	3	0·89	
10		Comillah	29 788	+·032	+·089	?	?	79·4	75·3	S.	8	9	3·26	
10	North Bengal	Bogra	29·697	+·049	?	82·5	89	82·8	75·8	E.	8	10	0·20	
10		Serajgunj	29·720	+·037	+·032	82·5	87	83·7	76·2	S.-S.-E.	6	8	0·40	
10		Rampore Bauleah	29·677	+·059	+·011	83·1	84	82·7	76·6	S.-E.	10	6	0·51	
10		Dinagepore	29·690	+·029	+·022	84·2	83	86 1	75 6	E.	15	9	0·30	
10		Jalpaiguri	29·749	+·040	+·066	80·5	88	81·9	74·8	E.	7	4	0·69	
10		Darjeeling	22 954	+·020	+·011	58·5	100	?	54·1	E.-N.-E.	8	10	0·97	
10	Behar	Purneah	29·635	+·017	—·059	79·6	96	79·7	73·1	E.-N.-E.	8	9	1·63	
10		Durbhunga	29·701	—·006	+·010	78·4	86	88·4	74·9	N.-N.-E.	11	10	1·01	
10		Motiharee	29·675	—·028	+·035	85·1	70	80·2	75·4	W.-N. W.	7	9	0·03	
10		Chupra	29·698	—·021	+·063	81·1	87	81·5	75·6	N.-N. W.	8	9	0·08	
10		Bhagalpur	29·569	+·010	—·090	78·8	91	79·3	75·0	E.	14	10	2·61	
10		Nya Doomka	29·056*	+·097	?	75·7	97	78·1	74·3	S.-S.-W.	14	10	0·51	
10		Patna	29·706	+·003	+·001	70.5	95	79·3	75·7	N.-E.	7	10	1·43	
10		Arrah	29·703	+·005	+·063	79·7	90	81·3	76·1	N.-W.	5	10	0·04	
10		Buxar	29·715	+·007	+·069	84·0	75	80·4	77 2	N.-N.-W.	7	8	*Nil.*	
10		Dehree	29·702	+·003	+·038	80·4	87	84·3	77·0	W.-N.-W.	10	10	0·07	
10		Gya	29·656	—·001	—·045	80·6	79	84·4	74·8	N.-W.	8	10	0·88	
10	Chutia Nagpur	Hazaribagh	29·688	+·017	—·033	71·6	96	74·4	70·2	N.-W.	34	10	2·72	
10		Ranchee	29·683	+·014	+·005	73·2	90	79·0	70·4	W.-N.-W.	19	10	0·22	

* Not reduced to sea level.

The principal facts which are shown by the meteorological data are as follows: In South and Central Bengal pressure was rising slowly, but steadily, the increase averaging about a twelfth of an inch; while at such stations as Burdwan, Bankoora, Raneegunge, and Midnapore it exceeded this, and at Nya Doomka the barometer had risen 0·097 inch In Behar and Chutia Nagpur, on the other hand, pressure was either steady or falling very slowly, but the changes were all more or less general in character, and there were no large local falls, thus showing that the storm was not advancing towards any station at which there was a meteorological observatory. The lowest pressures in the Province were at Bhagalpur, where pressure was 29·569 inches, and probably at Nya Doomka, where the pressure would have equalled about 29·55 inches or 29·56 inches when reduced to sea level. Judged therefore by these barometric pressures, it would seem that the storm was nearly stationary, and perhaps commencing to fill up, and it certainly had not advanced far from its previous position on the 25th. What appears however probably to have been the case was that the storm had on this day passed into the hills of the Sonthal Pergunnahs district, and that its advance was consequently retarded. The wind directions and velocities over the Province still clearly showed the existence of the storm. Thus at Bhagalpur wind was E. with a velocity of 14 miles an hour, at Nya Doomka wind was S.-S.-W., velocity 14 miles an hour and at Hazaribagh wind was N.-W., velocity 24 miles an hour, the observer also reporting a gale of wind. At Gya wind was N.-W., velocity 8 miles an hour, and at Patna wind was N.-E., velocity 7 miles an hour. These winds prove most clearly the existence of a cyclonic circulation in almost the same position as on the previous day. The storm centre still appeared to be in the Sonthal Pergunnahs district to the north-west or west-north-west of Nya Doomka, and to the south-west of Bhagalpur, and the advance of the storm was hence considerably retarded by the irregular line or series of lines of low hills which stretch from the Hazaribagh district to Monghyr. The centre of this storm, however, on this day was far removed from any meteorological observatory, and its precise position can only be roughly judged. It was most probably about south or south-south-east of Monghyr, or about 20 or 30 miles to the north-west of its position on the 25th. The velocity of movement of the storm from the 25th to the 26th was therefore only about a mile an hour, instead of 5 miles an hour, as on the previous day. It is also impossible to say whether the storm had altered in intensity on this day, for its centre was not sufficiently near to any observatory to enable more than a rough guess to be made of the height of the barometer at its centre.

The rainfall on this day was heavy and general over the whole Province and averaged nearly two inches. At very numerous stations falls of three inches and upwards were reported, particularly in South Behar, where on this day very heavy rain was falling as is shown in the following table:—

RAINFALL FOR THE TWENTY-FOUR HOURS ENDING 6 P.M.

26th August 1888.

Meteorological Division.	Average rainfall.	Heavy rainfalls exceeding 3 inches.		
		District.	Station.	Amount.
	Inch.			Inches.
ORISSA	0·29			
S. W. BENGAL	0·31	Burdwan	Cutwa	3·06
EAST BENGAL	0·66			
NORTH BENGAL	0·75	Maldah	Maldah	5·49
			Sibgunj	3·20
NORTH BEHAR	1·25	N. Bhagalpur	Maddapore	3·84
		Durbhunga	Tajpore	3·21
			Roshera	5·20
SOUTH BEHAR	2·52	Shahabad	Arrah	4·30
		Gya	Nowadah	6·23
			Jehanabad	3·26
			Arwal	3·10
			Pakri Barawan	5·50
		Patna	Behar	5·70
			Barrh	5·40
		Monghyr	Begooserai	4·20
			Jamui	6·28
			Sheikpura	4·15
		S. Bhagalpur	Kolgong	4·16
		Sonthal Pergunnahs	Rajmehal	7·32
CHUTIA NAGPUR	1·51	Hazaribagh	Pachamba	4·85
			Barhi	5·75
			Karagdeha	4·80

27th August 1888.—The meteorological data on which the discussion of the weather for this day depends are contained in the table below, which gives the 10 A. M. observations at the inland stations of Bengal, Behar and the neighbouring districts of the North-West Provinces. The barometric pressures and wind observations are charted on Plate XVI.

27th August 1888.

Hour.	Position of Station.	Station.	Barometer.			Temperature.	Humidity.	Temperature previous 24 hours.		Wind.		Cloud proportion.	Rainfall.	Weather Remarks.
			Actual reduced to 32° and sea level.	Change since previous 24 hours.	Variation from normal.			Maximum.	Minimum.	Direction.	Velocity. Miles per hour			
A.M.														
10	Orissa	Gopalpur	29·718	−·044	+·009	82·0	89	83·2	76·8	S.-S.-W	15	0	0·35	
8		Pooree	29·703	−·050	?	80·1	93	88·7	?	S.-S.-W.	11	8	0·02	
10		False Point	29·709	−·038	−·018	84·8	83	85·4	77·1	S.-S.-W	13	6	*Nil*	
10		Cuttack	29·699	−·061	−·013	87·1	72	88·9	76·8	Calm	4	7	0·14	
10	S. W. Bengal	Balasore	29·672	−·048	−·001	85·5	81	87·4	78·7	S.	7	8	*Nil*	
10		Midnapore	29·695	−·014	+·003	87·5	84	89·3	78·3	S	1	3	*Nil*	
10		Saugor Island	29·694	−·017	−·038	84·9	89	87·7	79·5	S.-S.-W	21	5	*Nil*	
10		Calcutta	29·676	−·046	−·060	84·3	81	86·5	79·7	W.-S.-W.	1	8	0·02	
10		Burdwan	29·658	−·003	−·072	83·9	77	88·1	78·9	S.	4	8	*Nil*	
10		Bankoora	29·664	+·012	?	84·9	78	85·1	76·6	S.-W.	5	6	0·03	
10		Raneegunge	29·632	+·038	−·020	84·4	80	84·5	76·8	S.-W.	5	4	*Nil*	
10		Berhampore	29·671	+·011	−·059	84·4	87	88·1	78·3	S.-W.	6	7	*Nil*	
10		Kishnaghur	29·692	−·012	+·006	83·7	81	88·8	79·2	S.	7	8	0·11	
10		Jessore	29·685	−·046	−·054	86·4	83	89·2	79·4	W.-S.-W.	3	8	*Nil*	
10	East Bengal	Furreedpore	29·707	−·042	+·011	83·1	86	85·5	78·9	S.	6	5	*Nil*	
10		Dacca	29·692	−·056	−·048	84·6	82	85·1	78·7	S.-S.-E.	6	8	0·01	
10		Burrisal	29·709	−·058	+·016	84·7	87	84·3	77·8	S.	5	8	*Nil*	
10		Mymensingh	29·701	−·054	−·006	81·2	89	86·9	77·5	E.-S.-E.	4	9	0·36	
10		Chittagong	29·754	−·069	−·028	77·2	97	84·6	76·0	S.-E.	6	10	0·84	
10		Comillah	29·710	−·078	−·010	83·7	83	83·4	77·7	S.	5	8	0·36	
10	North Bengal	Bogra	29·665	−·032	?	85·5	79	88·3	78·7	Calm	7	10	*Nil*	
10		Serajgunj	29·686	−·034	−·020	84·5	85	86·1	78·8	S.-E	5	6	*Nil*	
10		Rampore Bauleah	29·673	−·004	−·010	84·6	98	86·8	78·5	S.-E.	7	2	0·64	
10		Dinagepore	29·665	−·025	−·018	87·2	80	87·6	76·1	S.-S.-E	9	5	*Nil*	
10		Jalpaiguri	29·673	−·076	−·011	84·5	84	86·9	76·8	S.	5	8	*Nil*	
10		Darjeeling	22·924	−·030	−·020	61·5	97	63·1	55·6	Calm	5	6	0·18	
10	N.-W. Provinces.	Gorakhpur	29·616	−·084	−·065	76·6	93	90·3	75·5	E.	3	6	0·75	
10		Lucknow	29·633	−·103	−·034	82·7	83	88·3	77·8	N.-W	3	8	*Nil*	
10		Allahabad	29·636	−·105	−·038	82·2	81	89·8	78·3	W.-N.-W.	5	10	0·04	
10		Benares	29·635	−·086	−·049	79·2	90	89·5	75·4	W.-S.-W.	4	10	0·23	Gloomy.
10		Sutna	29·669	−·068	−·014	79·0	82	86·7	75·3	W.	9	8	*Nil*	Strong wind.
10	Behar	Purneah	29·654	+·019	−·063	86·1	84	82·7	74·1	S.-E.	6	4	2·72	
10		Durbhunga	29·560	−·141	−·147	79·9	89	79·9	75·8	E	15	9	2·76	
10		Motiharee	29·542	−·133	−·113	84·6	70	86·7	75·4	E.-N.-E	7	9	1·27	
10		Chupra	29·533	−·165	−·117	77·1	98	77·5	74·6	N.	8	10	6·40	
10		Bhagalpur	29·635	+·066	−·029	84·8	72	86·2	75·0	S.	9	3	0·56	
10		Nya Doomka	29·153*	+·097	?	83·2	82	83·6	75·3	S.-S.-W.	11	10	0·20	
10		Patna	29·490	−·216	−·226	76·0	98	77·8	75·2	N.-W.	5	10	3·42	
10		Arrah	29·537	−·166	−·122	75·7	96	81·3	74·1	W.	5	10	7·70	
10		Buxar	29·578	−·137	−·086	75·1	95	85·9	73·8	W.-N.-W.	5	10	5·60	
10		Dehree	29·598	−·104	−·083	76·9	93	82·3	74·0	S.-S.-W.	6	10	3·92	
10		Gya	29·571	−·085	−·144	78·6	79	81·4	73·3	W.-N.-W.	10	10	8·53	
10	Chutia Nagpur	Hazaribagh	29·644	+·073	−·081	73·6	93	72·4	69·7	W.-S.-W.	19	10	1·17	
10		Ranchee	29·639	−·005	−·030	77·2	82	79·0	76·9	S.-S.-W.	11	8	0·10	

* Not reduced to sea level.

On this day the changes were very much more marked than they had been on the previous day. Pressure had again risen by almost a tenth of an inch at Nya Doomka and by a somewhat smaller amount at Bhagalpur, pointing to the fact that the storm area was retreating from those stations. In the western part of Behar, however, pressure was falling exceedingly rapidly, the fall at Patna equalling 0·216 inch, while at Motiharee, Durbhunga, Chupra, Arrah, Buxar, and Dehree, it varied from a fifth to a tenth of an inch. The lowest pressure recorded was 29·490 inches at Patna, and next to this were pressures of 29·53 inches at Chupra and Arrah. Winds also showed a complete cyclonic circulation of considerable strength. Thus at Patna wind was N.-W., and velocity 5 miles an hour; at Arrah it was W., velocity also 5 miles an hour, and at Gya N.-W., velocity 10 miles an hour. At Hazaribagh wind was W.-S.-W., velocity 19 miles, and at Nya Doomka wind was S.-S.-W., velocity 11 miles. At Bhagalpur a southerly wind was reported, velocity 9 miles, at Purneah wind was S.-E., velocity 6 miles, at Durbhunga wind was E., velocity 15 miles and at Chupra it was N , velocity 8 miles. The circulation hence pointed to the existence of the storm centre to the west or slightly to the S. of W. of Patna. This was also proved by the general distribution of pressure, judged by which the storm centre was probably about 20 miles to the west of Patna.

From the low pressure recorded at Patna on this day, and from the fact also that the centre of the storm was not nearer than 20 miles from the station, it would appear that the depression at the centre was almost, if not quite, as great as it had been two days before, when it was almost passing over Kishnaghur, and it is therefore probable that the indications of the apparent filling up of the storm shown by the observations on the 26th were due to the fact that the storm centre was at a considerable distance from any meteorological observatory. On the 27th at 10 A.M. pressure at the centre of the storm was almost certainly as low as 29·4 inches or even as 29·35 inches. The storm had surmounted the Hazaribagh and Monghyr Hills, and had moved about 80 miles in a north-westerly direction since the 26th. As however it is impossible to say at what hour the storm had been able to break through the hills, it is useless to speculate on the rate at which the storm was moving during the period from 10 A.M. of 26th to 10 A.M. of the 27th.

The winds recorded in connection with the storm on this day were fairly strong, and gave somewhat stormy weather to a large part of the Province of Bengal, but as on the previous day (26th), in no case were the winds of anything like destructive fierceness.

As the storm began to advance over Behar, it commenced to give heavy rainfall, and at many stations from the 26th to the 27th falls of 5 inches and upwards were recorded. The falls were heaviest in South Behar, where Jehanabad recorded 9·05 inches, Gya 7·59 inches, and for which the falls averaged 2·68 inches. The actual average falls in the various meteorological divisions of the province, and the falls at stations where they exceeded 3 inches, are shown in the following table:—

RAINFALL FOR THE TWENTY-FOUR HOURS ENDING 6 P.M.
27th August 1888.

Meteorological Division.	Average rainfall.	Heavy rainfalls exceeding 3 inches.		
		District.	Station.	Amount.
	Inch.			Inches.
ORISSA	0·17	.....	......	...
S. W. BENGAL	0·29	Bankoora	Sonamukhi	3·31
EAST BENGAL	0·51	Chittagong	Kutubdia	5·85
NORTH BENGAL	0·23	......	...	...
NORTH BEHAR	1·91	Purneah	Balarampore	3·50
		Mozufferpore	Hajipore	3·51
			Paru	4·60
			Mahua	3·26
		Sarun	Gopalgunge	6·00
			Sewan	4·91
			Chupra	3·47
SOUTH BEHAR	2·68	Shahabad	Buxar	6·27
			Dehree	3·92
			Sasseram	5·31
			Arrah	5·50
		Gya	Arungabad	4·16
			Gya	7·59
			Nowadah	5·00
			Jehanabad	9·05
			Arwal	6·74
			Daudnagar	5·07
			Sherghati	3·50
		Patna	Patna	3·13
			Dinapore	4·80
			Bickram	6·25
			Hilsa	5·45
CHUTIA NAGPUR	0·74	Manbhoom	Raghunathpore	3·21
ALLAHABAD	0·42	Jaunpur	Mariahu	4·80
			Jaunpur	3·06
BENARES	1·45	Ghazipur	Zamaniah	3·70
			Ghazipur	3·67
		Ballia	Rasra	4·10
			Ballia	5·43

28th August 1888.—The meteorological data on which the discussion of the weather of this day depends are contained in the following table, and the principal facts as to pressure and wind direction are charted on Plate XVI :—

28th August 1888.

Hour.	Meteorological Division.	STATION.	BAROMETER.			Temperature.	Humidity.	TEMPERATURE PREVIOUS 24 HOURS.		WIND.		Cloud proportion.	Rainfall.	WEATHER REMARKS.
			Actual reduced to 32° and sea level	Change since previous 24 hours.	Variation from normal.			Maximum.	Minimum.	Direction.	Velocity. Miles per hour.			
A.M.														
10	Orissa	Gopalpur	29·718	0	−·009	83·6	82	83·2	78·3	S.-S.-W.	8	1	0·18	
8		Pooree	29·707	+·004	?	81·6	89	86·7	82·5	Calm	0	0	*Nil*	
10		False Point	29·692	−·017	−·044	86·8	70	85·9	77·1	W.-S.-W.	11	7	0·18	
10		Cuttack	29·689	−·010	−·032	87·1	68	90·4	77·9	W.-S.-W.	3	6	*Nil.*	
10	S. W. Bengal	Balasore	29·662	−·010	−·033	86·5	82	89·4	79·7	S.-S.-W.	12	6	*Nil*	
10		Midnapore	29·680	−·015	−·030	86·5	88	89·8	78·3	S.-W.	2	4	1·12	
10		Saugor Island	29·663	−·031	−·082	85·4	87	88·2	79·5	S.-W.	14	9	*Nil*	
10		Calcutta	29·656	−·020	−·089	85·3	83	88·0	79·2	W.-S.-W.	5	9	*Nil*	
10		Burdwan	29·645	−·013	−·103	85·4	79	89·6	78·9	S.-S.-W.	1	8	*Nil*	
10		Bankoora	29·637	−·027	?	85·4	79	88·6	77·5	W.	2	6	0·30	
10		Raneegunge	29·634	+·002	−·033	85·4	79	90·0	76·8	S.	1	6	0·08	
10		Berhampore	29·650	−·021	−·086	84·4	87	89·6	77·3	S.-W.	4	8	0·07	
10		Kishnaghur	29·682	−·010	−·023	84·7	83	89·8	75·3	Calm	3	9	0·20	
10	East Bengal	Jessore	29·669	−·016	−·080	86·4	85	89·7	79·4	S.	3	9	0·02	
10		Furreedpore	29·690	−·017	−·025	83·1	87	86·5	79·9	S.-S.-E.	4	5	*Nil*	
10		Dacca	?	?	?	85·6	82	89·1	79·7	S.-S.-W.	6	8	*Nil*	
10		Burrisal	29·683	−·026	−·040	83·7	87	87·3	76·8	S.	5	9	0·10	
10		Mymensingh	29·683	−·018	−·040	78·2	93	87·3	78·5	S.-S.-E.	3	10	0·24	
10		Chittagong	29·728	−·026	−·063	80·7	88	82·6	76·0	S.-E.	5	9	0·56	
10		Comillah	29·696	−·014	−·051	84·2	81	87·4	77·7	S.-E.	5	3	0·95	
10	North Bengal	Bogra	29·643	−·022	?	85·5	81	87·3	78·7	Calm	1	10	0·14	
10		Serajgunj	29·655	−·031	−·078	84·0	88	88·1	79·8	S.	4	8	*Nil*	
10		Rampore Bauleah	29·653	−·020	−·052	84·6	88	87·4	78·5	S.-E.	3	0	0·09	
10		Dinagepore	29·648	−·017	−·059	84·7	94	91·1	78·1	S.-E.	2	4	1·35	
10		Jalpaiguri	29·632	−·041	−·075	84·5	84	91·0	77·9	N.-E.	2	0	*Nil*	
10		Darjeeling	22·890	−·034	−·070	61·0	97	66·6	56·1	S.-W.	7	8	0·01	
10	N.-W. Provinces	Gorakhpur	29·584	−·032	−·117	79·2	89	81·0	76·0	W.	4	6	0·42	
10		Lucknow	29·680	+·047	−·018	78·7	93	88·3	73·8	S.	3	10	2·02	
10		Allahabad	29·646	+·010	−·048	79·2	94	83·1	77·2	W.-N.-W.	5	10	0·28	
10		Benares	29·611	+·024	−·083	81·4	87	79·8	76·0	W.	9	10	0·92	Strong wind.
10		Sutna	29·683	+·014	−·023	80·0	80	82·6	75·3	W.	9	8	*Nil*	Gloomy.
10	Behar	Purneah	29·632	−·022	−·106	87·1	78	89·7	75·6	S.	2	3	*Nil*	
10		Durbhunga	29·630	+·070	−·086	84·5	83	84·9	76·8	E.-S.-E.	7	4	*Nil*	
10		Motiharee	29·599	+·057	−·084	83·1	79	84·7	75·4	S.-E.	19	9	0·16	
10		Chupra	29·608	+·075	−·067	84·1	91	84·5	75·6	S.-W.	11	7	0·75	
10		Bhagalpur	29·640	+·005	−·047	86·7	80	89·2	75·0	S.	3	2	0·68	
10		Patna	29·624	+·134	−·105	83·1	89	86·8	75·2	S.-E.	7	8	0·98	
10		Arrah	29·605	+·068	−·078	79·7	94	80·8	74·1	S.-S.-W.	8	10	2·27	
10		Buxar	29·577	−·001	−·107	77·5	95	77·9	74·3	W.	18	10	4·00	
10		Dehree	29·616	+·018	−·076	82·4	87	84·3	76·0	S.-S.-W.	13	8	0·15	
10		Gya	29·614	+·043	−·115	82·1	81	83·9	77·3	S.-S.-W.	8	5	0·20	

The principal facts shown in these observations are, first, that there had been a very rapid rise of pressure at some of the stations in Behar, and the rise at Patna, near which the storm centre had been on the previous day, equalled 0·134 inch.

On the other hand, pressure had fallen generally at the foot of the hills in the north of Behar and Bengal, and at Gorakhpur in the North-Western Provinces.

The lowest pressure recorded on this day at 8 A.M. over the whole of India excluding the extreme north-west of the Punjab, was 29·563 inches at Gorakhpur, where there had been a fall of 0·058 inch since the previous day. At this hour also at Gorakhpur wind was E.-N.-E., and velocity 5 miles an hour. At 10 A.M. pressure at Gorakhpur was 29·584 inches, with a fall of 0·032 inch only since the same hour on the previous day, showing that pressure was probably rising between 8 and 10 A.M. Wind had also gone round from E.-N.-E. at 8 A.M. to W., while velocity remained at 4 miles at 10 A.M. It appears, therefore, probable, that the centre of the storm, which was rapidly decreasing in intensity, was passing close to Gorakhpur between 8 and 10 A.M. of the 28th August, and was at 10 A.M. a little to the north of that station. It would hence seem to have moved in a N.-W. direction over a distance of about 150 miles since the previous day, or at the rate of about 6 miles an hour. The slight fall which took place at Gorakhpur, and the fact that the pressure did not fall below 29·55 inches, shows how rapidly the storm had been filling up during the 27th. On the morning of the 28th it was so feeble as to be scarcely classed as a storm at all, or even as a barometric depression. To the south and east of the disintegrating storm, fairly strong winds had continued to blow during the 27th. Thus Motiharee had registered a wind velocity of 19 miles an hour since the 27th, Buxar 18 miles, and Dehree 13 miles on. Over the remainder of the Province of Bengal moderate winds only were blowing at this time, and weather had become of ordinary monsoon character.

The rainfall accompanying the storm on this day was much lighter than on previous days, and the area of heaviest rainfall had been transferred from Behar to the Benares District of the North-Western Provinces. The average rainfalls over the Province of Bengal and in the Allahabad and Benares districts of the North-Western Provinces are given in the following table:—

RAINFALL FOR THE TWENTY-FOUR HOURS ENDING 6 P.M.

28th August 1888.

Meteorological Division.	Average rainfall.	HEAVY RAINFALLS EXCEEDING 3 INCHES.		
		District.	Station.	Amount.
	Inch.			Inches.
ORISSA . . .	0·02			
S. W. BENGAL . .	0·14			
EAST BENGAL . .	0·45	Mymensingh . .	Durgapore . . .	4·00
NORTH BENGAL . .	0·31	Cooch Behar . .	Dinhatta . . .	3·71
NORTH BEHAR . .	0·33			
SOUTH BEHAR . .	0·42			
CHUTIA NAGPUR .	0·29			
ALLAHABAD . .	0·20			
BENARES . . .	1·35	Azamgarh . .	Deogaon . . .	3·70
			Mahul	3·20
			Azamgarh . . .	4·70
			Jiwanpur . . .	4·10
			Muhammadabad . .	5·40

29th August 1888.—It has already been shown in the meteorology of the 28th that the storm had almost ceased to exist on that day. The observations taken on the morning of the 29th August failed to show any trace of the existence of the storm as such, though perhaps there was still a residual cyclonic circulation of winds over part of the North-Western Provinces. For all practical purposes, however, the storm ceased to exist on the evening of the 28th, and it is, therefore, unnecessary to discuss the meteorology of the 29th August in detail

TRACK OF THE STORM.

The following is a short description of the track of the storm, which is given on Plate XVII. The storm was first formed on August 21st, when the centre, so far as can be ascertained, was perhaps 30 or 40 miles from the land and south-east of Saugor Island. On the 22nd the storm centre was just inland and over the Sunderbuns, perhaps 20 or 25 miles to the east or east-north-east of Saugor Island. It had therefore moved about 30 or 40 miles in an almost northerly direction during the day, or at the rate of rather less than two miles an hour. On the morning of the 23rd the storm centre was about 20 or 25 miles to the south-east of Calcutta, and it had therefore again moved about 40 to 50 miles in a northerly direction, but slightly inclined towards the west, and the average velocity of the movement of the storm for the previous day was therefore about 2 miles an hour. The storm centre passed close to the east of Calcutta on the evening of the 23rd, and on the morning of the 24th it was close to Kishnaghur, and had moved in a north-north-westerly direction about 75 miles, or at the rate of a little more than 3 miles an hour. The direction of the movement then became a little more westerly, and from the 24th to the 25th it travelled 80 miles in a north-westerly direction, and the centre on the morning of the 25th was to the east or north-east of Nya Doomka. It then apparently became entangled in the low hills in this part of the country, and during the next 24 hours made very little progress, probably advancing not more than perhaps 30 miles. On the 27th, however, the storm surmounted the hills, which run from the Hazaribagh district to Monghyr, and advanced about 120 miles in the 24 hours in a north-westerly direction to near Patna. Lastly on the 28th the centre was near Gorakhpur in the North-Western Provinces, and had travelled during its previous 24 hours about 180 miles in a west-north-westerly direction, but during this last day's advance the storm filled up very rapidly, and on the 28th practically ceased to exist as a definite storm.

DISCUSSION OF THE WIND DIRECTION AND FORCE OVER THE AREA WHERE THE STORM WAS BEING FORMED AND FOR THE FIRST TWO OR THREE DAYS OF ITS EXISTENCE.

The following two tables contain the observations of wind direction and force obtained from the traces of the two Beckley's anemographs, which are in use at the Saugor Island Observatory and at the Calcutta (Alipore) Observatory. In the case of the Saugor Island anemograms, the results are given for the period August 20th to the 24th inclusive, and of the Calcutta anemograms from the 21st to the 25th. These observations are supplementary to those which have been already given in the daily tabular statements of the general meteorological observations, and all these data can be discussed together.

SAUGOR ISLAND.

Hourly wind directions and velocities from 20th to 24th August 1888.

DATE.		12 TO 1.		1 TO 2.		2 TO 3.		3 TO 4.		4 TO 5		5 TO 6		6 TO 7		7 TO 8		8 TO 9.		9 TO 10.		10 TO 11.		11 TO 12.	
		Velocity in miles.	Direction.	Velocity in miles	Direction.	Velocity in miles	Direction.	Velocity in miles	Direction.	Velocity in miles	Direction.	Velocity in miles	Direction.	Velocity in miles	Direction	Velocity in miles	Direction.	Velocity in miles	Direction.	Velocity in miles	Direction.	Velocity in miles	Direction.	Velocity in miles.	Direction.
1888.																									
20th August .	. A.M.	8	S.-S-E	15	S.	16	S.-S-W	8	S.-S-W.	5	S-W.	4	S-W	4	S.-W.	4	S-W.	3	N.-E	5	N-N.-E.	5	N-N-E.	8	S.-S.-E
Do. .	. P.M.	9	S-S-E	10	S-S-E.	8	S.-E.	8	S.-S-E	14	S-S-E.	13	S.-S-E.	15	S.-S.-E.	12	S	13	S.	10	S.	10	S	9	S.
21st August .	. A.M.	9	S-S-W.	12	W-S.-W.	10	W	10	W.	7	W-N-W.	11	N-W.	11	N.-N.-W.	6	N-N-W.	8	N.	7	W.-N-W.	15	W-N.-W.	18	N.-W.
Do. .	. P.M.	17	N.-W.	20	W.	25	W.-N.-W.	30	N-W.	27	W.-N.-W.	28	N.-N.-W.	22	N.-N-W	21	W.-N-W.	26	W.	19	N.-W	22	N-W	20	W.-N.-W.
22nd August .	. A.M.	22	W-N-W.	23	N-W.	17	N.-W.	16	W-N-W.	17	W.	18	W.-N.-W.	12	W-N-W.	15	W.-N.-W.	10	W.-N-W.	10	N-N-W.	23	S.-W.	14	W.-N.-W.
Do. .	. P.M.	9	W-N.-W.	8	W.	9	W-S.-W.	12	S-E.	10	E-S-E	6	E-S.-E	7	E.-S-E	18	S.-S-W.	12	S	10	E.	12	N.	15	N.-N.-W.
23rd August .	. A.M.	17	N.-W	11	N.-W.	16	W.	17	W.-S-W.	17	S-W.	19	W.-S.-W.	19	W.-S.-W.	16	W.	12	N.-N.-W.	16	W.	28	W.-S.-W.	19	W.-S.-W.
Do. .	. P.M.	28	W.	35	W.-S.-W.	40	S.-W.	50	S-W.	50	S.-W.	50	S-S-W.	50	S-W.	52	S.-W.	55	S-W.	50	W-S-W.	50	S.-W.	60	S.-S.-W.
24th August .	. A.M.	Instrument out of order									...	..	...	60	S.-S-W	55	S.-S.-W	55	S.-S.-W.	50	S.-S.-W.	40	S.-S-W.	50	S.-S.-W.
Do. .	. P.M.	50	S.-S.-W.	42	S-S-W.	48	S.-S.-W.	No record		44	S.-W.	45	S.-W.	38	S-S. W.	32	S-S.-W.	35	S.-S-W.	35	S-S.-W	38	S-S-W.	50	S.-S.-W.

CALCUTTA (ALIPORE).

Hourly wind directions and velocities from 21st to 25th August 1888.

DATE.		12 TO 1.		1 TO 2.		2 TO 3		3 TO 4.		4 TO 5.		5 TO 6		6 TO 7.		7 TO 8.		8 TO 9.		9 TO 10		10 TO 11		11 TO 12.	
		Velocity in miles.	Direction.	Velocity in miles.	Direction.	Velocity in miles.	Direction.	Velocity in miles.	Direction.	Velocity in miles.	Direction.	Velocity in miles.	Direction.	Velocity in miles	Direction.	Velocity in miles.	Direction.	Velocity in miles.	Direction.	Velocity in miles.	Direction.	Velocity in miles.	Direction.	Velocity in miles.	Direction.
1888.																									
21st August .	. A.M.	1	S-S.-W.	1	S.-S-W	2	S.-S.W	4	S-S.-W.	3	N-N.-W.	5	N. by W.	5	N.-N.-E.	7	N.-N.-W.	3	N.-N.-W.	5	N.-N.-W.	8	N.	9	N.-N.-E.
Do. .	. P.M.	9	N. by E	14	E.-N.-E	10	E.-N.-E	15	E-N.-E	10	E-N.-E.	9	E.-N-E.	6	E. by N.	5	E.-N.-E.	9	E.-N.-E.	6	E.-N.-E.	6	E.-N.-E.	9	N.-E. by E.
22nd August .	. A.M.	7	N.-E.	6	N.-E by E.	7	N-E	7	E.-N.-E	6	E.-N-E	11	E-N.-E.	12	E.-N.-E.	14	E.-N.-E.	13	E.-N.-E.	14	E.-N.-E.	16	E.-N.-E.	16	N.-E.
Do. .	. P.M.	13	E.-N.-E	13	E.	13	E.-S.-E	11	E-S-E	10	E.	10	E.	8	E.	6	E.	7	E.-N.-E.	9	E.	11	E.	10	E.
23rd August .	. A.M.	11	E.	10	E.	11	E. by N	10	E.-N.-E	8	N-E. by N.	7	N-E by N	5	N.-E.	10	N.-E.	8	N.-E.	9	N.-N.-E	7	N.-N.-E.	8	N.-E.
Do. .	. P.M.	11	N.-N.-E	10	N.-E.	10	E.-N.-E	8	E.	6	E.-N.-E	4	N.-E by N.	7	N.-N.-E.	5	N.-N.-W.	7	N.-N.-W.	8	N.-W. by W.	5	N.-N.-W.	3	N. N.-E.
24th August .	. A.M.	2	N.-N.-E.	10	W.	11	W.	18	W.	25	W.-S.-W.	20	W.-S-W.	32	W.-S.-W.	34	W.-S.-W.	24	W.-S.-W.	27	W-S.-W.	26	W.-S.-W.	27	W.-S.-W.
Do. .	. P.M.	26	W.-S.-W.	27	W.-S.-W.	18	S-W by W.	25	S-W.	19	S.-W.	23	S.-W.	23	S.-W.	21	S.-S.-W	26	S.-W.	20	S-S.-W.	23	S.-W.	22	S.-W.
25th August .	. A.M.	20	S.-W.	20	S-W.	18	S-W.	18	S.-W.	17	S.-W.	17	S.-W.	15	S.-W.	15	S.-W. by W.	13	S.-W.	19	S.-W.	13	S.-W.	13	S.-W.
Do. .	. P.M.	17	S.-W.	17	S.-W. by S.	13	S-W. by S.	14	S-S-W.	11	S-S-W.	14	S-S.-W.	11	S.-S.-W.	12	S-S.-W.	13	S.-S.-W	14	S-S.-W	11	S.-S.-W.	15	S.-S.-W.

It has already been shown that the storm had no definite existence on the 20th August, though somewhat squally weather obtained in the centre of the Bay, but that on the 21st there were distinct indications of the existence of a storm centre a short distance to the south-east of Saugor Island. It is interesting therefore to note closely the winds from the 20th to the 21st at Saugor Island and at Calcutta. In the early morning of the 20th August at Saugor Island wind usually varied from S.-S.-W. to S.-W., but velocity was small, ranging from 8 to 3 miles an hour, the velocity steadily decreasing. A light north-easterly wind then sprang up, which lasted for three hours from 8 to 11. From noon to 7 P.M. wind was S.-S.-E. and steadily increased in force up to about 15 miles an hour, when it shifted round to S., and velocity became about 9 miles an hour, and remained practically unchanged till midnight. It is clear then that very light and variable winds prevailed on the 20th over the area where the storm was perhaps already commencing to develop. On the 21st at 8 A. M. there were distinct indications of the storm forming a little to the south-east of Saugor Island, and yet from midnight of the 20th to 1 A.M. of the 21st wind at Saugor Island was S.-S.-W., velocity 9 miles an hour, and from 1 to 2 A. M W.-S.-W., velocity 10 miles an hour, and from 2 to 4 A. M. wind was W., velocity 10 miles an hour. During the same interval on the 21st wind at Calcutta was S.-S.-W., and of velocity 1 to 4 miles an hour. These winds clearly formed no part of a cyclonic circulation. From 4 to 6 A. M. at Saugor Island wind became W.-N.-W., N.-W., and N.-N.-W., the velocity being from 7 to 11 miles an hour. At Calcutta at 4 A. M. wind was N.-N.-W., at 5 A.M. N. by W., and at 6 A. M. N.-N.-E., with a velocity of 5 miles an hour. From 4 A. M. of the 21st winds then commenced to form part of a cyclonic circulation, and of an indraught towards the centre of the commencing storm. From 7 A. M. to 8 A. M. wind at Saugor Island was N.-N.-W., velocity 8 miles, and at Calcutta N.-N.-W., velocity 3 miles, showing again feeble indraught and yet at that hour the centre had certainly a definite existence not far away from Saugor Island. It is clear, therefore, that up to 4 A.M. of the 21st there was no well defined centre of circulation of winds, and that the first real indications of the commencing storm date from the period 4 to 8 A. M. of the 21st August. During the 21st from 9 A.M. and up to mid-day of the 22nd, wind at Saugor Island kept practically between W.-N.-W. and N.-W., the wind however not remaining perfectly steady, but at times going round to W. and once to S.-W., and for a short period to N.-N.-W. For a considerable portion of this time it was steadily increasing in strength. Thus from 9 to 10 A. M. on the 21st, velocity was 7 miles, from 11 to 12 it increased to 18 miles, from 2 to 3 P M. it was 25 miles an hour, and from 3 to 4 P.M. 30 miles; but velocity then steadily decreased until it had fallen to 9 miles between mid-day and 1 P. M. of the 22nd. At Calcutta wind remained at N.-N.-W. till 10 A. M. of the 21st, and then went through N. and N.-N.-E. to E.-N.-E., and remained almost steady at this direction until 1 P.M. of the 22nd. Here also wind steadily increased in velocity during this time and at noon on the 22nd a velocity of 16 miles an hour was registered.

As pointed out previously there appears to be no doubt that on the morning of the 22nd the centre of the storm had advanced over the land, and that its centre was a short distance to the east of Saugor Island at 8 A. M., but though this was the case, during the afternoon of the 22nd winds at Saugor Island became very variable in direction and force. Thus between 1 and 2 P. M. wind was W., velocity 8 miles, from 3 to 4 P. M. it was S.-E., velocity 12 miles, from 8 to 9 P. M. it was S., velocity 12 miles, from 9 to 10 P. M. it was E., velocity 10 miles, and from 10 to 11 P. M. it was N., velocity 12 miles. It then went round through N.-N.-W. and W. to W.-S.-W. at 3 A. M. on the 23rd, when the velocity increased up to 17 miles. During this time there appears to be no reasonable doubt that the storm centre was gradually advancing northwards, as is proved by the general wind circulation at some distance from the centre and the changes of pressure. At Calcutta during this period and up to 3 A. M. of the 23rd wind was steadily from an easterly direction, and the velocity remained practically unchanged at from about 10 to 13 miles an hour. From 3 A. M. of the 23rd wind at Saugor Island became W.-S.-W., and velocity increased slightly to about 17 miles, and with very slight exceptions wind remained steady at W.-S.-W., S.-W., and S.-S.-W. for the whole of the 23rd and 24th August. Velocity also remained almost unaltered from 3 A. M. of the 23rd to nearly mid—day, and from 11 A. M. to noon was only 19 miles in amount. After this however a change took place in the wind strength which will be referred to later on. At Calcutta at 3 A. M. of the 23rd wind became more northerly than it had been, and remained more or less steadily at N.-E. till 7 P.M. Wind velocity also was about 10 miles an hour in the early morning, and fell to 4 miles an hour at between 5 and 6 P.M. At 7 P.M. wind went round from N.-N.-E. to N.-N.-W., and there is no doubt that at about this time the storm centre was passing only a few miles, probably not more than 4 or 5 miles, to the east of Calcutta.

It will be seen that the above velocities represent extremely light winds; but cloud observations, however, were made during the 22nd and 23rd at Calcutta, which proved that, though the lower air currents were very feeble as the above records show, and light airs and calms prevailed close to the ground, the clouds (which were comparatively low) were moving with extreme velocity. The change also in the direction of the cloud movements which was also noted, distinctly showed that from the 22nd to the evening of the 23rd, the storm centre was advancing in a northerly direction towards Calcutta, and that the centre was approaching that station a little to the eastward of it. The movement of the clouds, it was observed, was of a rapidity that has been rarely equalled in the experience of the writer, extending over many years; and yet, as has been stated, the surface air was almost calm during the whole of the period.

While these light airs prevailed at Calcutta and feeble winds at Saugor Island at 10 A.M., at the same hour a hurricane (*i.e.*, W.-S.-W. winds of force 12) was blowing on the Mutla light-ship, which is only 58 miles S.-E. of Saugor Island. The position of the Mutla light-ship was probably at this time about 90 miles to the south of the storm centre as judged by the wind circulation. Later on in the day conditions of wind velocity changed rapidly at Saugor Island. As previously stated, the velocity at that station was 19 miles an hour in the morning, and continued unchanged till 12 o'clock. From mid-day to 1 o'clock however the velocity increased to 35 miles, from 2 to 3 P.M. to 40 miles, and from 3 to 4 P.M. to 50 miles, or to a severe gale of wind; while wind force continued to increase until the very high velocity of 60 miles, as recorded in the Beckley's anemograph, was reached. This continued for many hours, and it was only at 6 P.M. of the 24th that the severity of the wind began to abate. The position of the storm centre at about mid-day was probably about 15 miles to the south-east of Calcutta, or 75 or 80 miles north-east of Saugor Island; and yet it was only at the latter distance from the storm centre (as judged by the wind circulation), that wind velocities were increasing in force to a gale. It is, therefore fully proved that on the 23rd no strong winds prevailed nearer to the storm centre than about 80 to 90 miles, and that these strong winds also only existed directly to the south of the storm. It is also shown that there was a fairly sharp line of demarcation between the inner area of light winds and the outer area of extremely strong winds to the south. The storm has been proved in the previous discussion to have only been moving at this time in a northerly direction at the rate of not much more than 3 miles an hour, so that from 12 (mid-day) to 3 P.M., it could have only advanced about 9 miles, and yet the observations at Saugor Island prove that at 71 miles from the storm centre wind velocity was 19 miles an hour, *i.e.*, a light to moderate wind only was blowing, while at 80 miles from the centre, the velocity was 50 miles and upwards, or a severe gale of wind was experienced.

The suddenness of this change in wind velocities in the area to the south of the storm is also shown clearly in some of the observations taken on board the ships which were on this day proceeding to sea from Saugor Island. Thus Captain Spence of the *Ooriya*, who is a very experienced observer, writes in his description of the weather of August 23rd: "Saugor Island, Thursday morning—Wind light N.-W., but dense clouds hanging all round, and very heavy rain. Thinking that by going to the southward I should get out of the dirty weather, and as there was, and had been, but very light wind, I got under weigh and went down the Western Channel. The weather cleared up a little about 7 A.M. and the wind freshened up from the N.-W., and it remained so until 11 A.M., *when the wind flew to west and blew with terrific force,* and very heavy rain By this time we were about 25 miles S.-S.-W. of Saugor Island." The same fact is also proved by the observations of Mr. Ransom (Branch Pilot) who was on board the *Loodiana*, which started on the morning of the 23rd from Saugor Island, steaming slowly southwards towards Madras. Mr. Ransom writes: "August 23rd, 7-40 A.M.—Weighed to proceed to sea. Light N.-W. breeze. 9 A.M.—Passed Long Sand Light. Moderate N.-W. breeze 9-45 A.M.—Upper Gasper Light. Heavy breakers on Long Sand and increasing sea. Wind as before. 10-25 A.M.—Lower Gasper Light. Very wild appearance to westward. Sea becoming breakers. 11 A.M.—By this time wind had hauled to west and west-south-west, each squall increasing in violence and the sea overwhelming the vessel. Noon—Bell Buoy. W.-S.-W. 1 mile. Squalls most violent with a terrific sea. Overhead it seemed as if the sun was shining, but after each squall the next appeared more violent."

From these extracts of observations by competent and experienced observers, there can be no doubt of the fact that the transition from comparatively light winds with very moderate, if not fine, weather, to winds of almost hurricame violence with terrific sea was almost sudden, the change taking place within a few miles.

The same contrast of conditions can also be proved to have existed on the following day, the 24th. It has already been shown that the storm centre passed to the east of Calcutta at about 7 o'clock in the evening of the 23rd, and that it was close to Kishnaghur, which is 57 miles north of Calcutta, at 10 A.M. of the 24th. Wind velocity at Calcutta from midnight of the 23rd to 1 A.M. of the 24th was two miles an hour; from 1 to 2 A.M. of the 24th wind was W., velocity 10 miles an hour; and from 2 to 3 A.M. also W., velocity 11 miles, both of which may be considered moderate winds. Wind continued in the same direction from 3 to 4 A.M. but strengthened to 18 miles, and from 4 to 5 A.M. it had become W.-S.-W., velocity 25 miles, and the velocity subsequently increased to 34 miles an hour between 7 and 8 A.M., the direction remaining the same. These last-named velocities are large for Calcutta, and at that time a severe gale was blowing. As the storm was moving slowly northward at about the rate of three miles an hour, it is easy to calculate the position of the strong winds with reference to the centre, and it is clear that on this day the position of the strong winds was about 35 to 40 miles to the south of the centre instead of 80 to 90 miles as on the previous day, and that thus in its passage northward over the land, the area of strong winds to the south of the storm was closing up rapidly towards the centre.

That in many of the storms of the rains the main force of the wind is to a great extent confined to the south and south-east of the centre has been already proved, and thus Mr. Eliot in his book " Hand-book of cyclonic storms in the Bay of Bengal" (pages 210, 211) states—" In storms near the head of the Bay or which advance to the head of the Bay, the strongest winds appear to be experienced in the south-east quadrant or to the south and south-east of the storm centre, and these winds extend to very considerable distances from the centre and finally merge into the intensified south-west winds which prevail in the south of the Bay. In the case of cyclonic storms approaching the Coromandel coast, the strongest winds are usually experienced to the north and east of the storm centre, and usually extend to much greater distances to the north than to the south."

It is therefore not intended to put forward the case of this storm as being exceptional in the fact that the strong winds were confined to the southern quadrant, for the great majority of the cyclonic storms of the rains present this feature more or less strongly. It is, however, believed that in this case this feature was developed to an exceptional extent. It is also believed that the storm was remarkable in that there was an unusually sharp line of demarcation between the comparatively light winds which surrounded the centre on all sides, and which on the 23rd extended over a diameter of 160 to 180 miles, and the area of almost hurricane winds to the south of it.

A little reflection will show what peculiar and interesting features these represent. The general conditions of cyclonic storms are now well understood, and it is proved beyond any reasonable doubt, that in such a storm the winds blow in a spiral manner towards the centre, the winds being *drawn* towards a centre of low pressure which acts as a kind of axis round which the winds circulate. The whole of the evidence available, shows that the energy which causes the winds to blow round and towards the centre exists in the aqueous vapour contained in the air, and this energy is liberated by its condensation into the torrential rainfall occurring within the storm area, and that therefore the winds are not caused by the action of any unusual force or cause acting *outside* the storm itself. It will, therefore, clearly follow that the further away from the inner area of the storm a particle of air is situated the more feeble will be the force acting upon it and drawing it towards the centre of the storm, and the nearer to the centre roughly speaking the greater will be the force acting upon the particle. It has previously been said that the particles of air move towards the centre of the storm in a more or less spiral manner. Therefore even assuming that the spiral tendency is *very strongly* developed, a particle of air starting from the southern quadrant of a storm would certainly have to pass through the eastern and part of the northern quadrant before it could reach the centre. And if the spiral tendency be smaller in amount than that above suggested, and this is probably the case, particularly near the storm centre where winds are nearly circular, it is probable that a particle of air starting from the south of the storm at some distance from the centre would make a complete revolution round the centre or axis of the storm before being involved in the ascending current which undoubtedly exists within the inner area. It can also be understood how, when the winds from the outer and very large circumference of a storm area, acted on by forces which exist within the storm area itself, and which may be supposed to be greatest near the storm centre, pour in spirally and continually towards smaller circles near the centre of the storm, that the wind force must increase very materially, and that the winds will increase in intensity from the outer circumference of the storm towards the centre, the winds reaching their maximum force immediately outside the central calm area. That this is the case has been proved in abundant instances in the history of the cyclones of the transition periods, *i.e.*, when the storms form during a comparatively still condition of the atmosphere and when barometric pressures round the Bay are almost uniform. But in the case of the cyclonic storms of the rains, the history of which has been worked out in numerous cases by Mr. Eliot, Meteorological Reporter to the Government of India, there is usually no calm centre observed at all in the passage of the storm over the land. In very many cases also, though not in all, it is found that the winds are more or less feeble near the centre and for some considerable distance away from it. That is, over the area which in ordinary cyclones is the position of the fiercest winds, in the storms of the rains winds are sometimes of feeble character, while the strong winds are many miles away to the south or south-east of the centre, where in the intense cyclones of the transition periods winds are lighter than towards the centre.

Is it to be admitted that there is in the cyclonic storms of the rains a reversal of the ordinary law of cyclonic action, or, that winds may be very strong in the outer area and feeble in the inner area, and that the very strong or hurricane winds to the south of the storm, as they gradually approach in a spiral direction towards the centre, lose their velocity so rapidly that there is no trace of their existence to be found nearer than perhaps 60 or 80 miles from the centre, and that no strong winds are to be found to the east, north and west of the centre of such a storm ? This can scarcely be admitted, for the cyclonic storms of the rains and the cyclones of the transition periods are formed by similar causes and only differ in details of severity, size, &c.

Though in this section of the paper it is not intended to deal generally with the pressure recorded in this storm, yet as the distribution of the barometric pressure and the wind force in a storm are intimately connected, a few words may be said with reference to the general distribution of pressure in cyclones and cyclonic storms. In the case of all large cyclones, that is, in the cyclones of the transition periods, pressure falls steadily from the outer circumference towards the centre, the lowest pressure being recorded in or near the calm centre, and frequently the fall from the outer to the inner area is very large, amounting to perhaps two inches. The distribution of pressure, however, which is observed in the storms of the rains is very different, and the barometric depression which attends such storms is generally small in amount, amounting to only a few tenths of an inch, though the low pressure area is frequently of wide extent. And in some of the storms of the rainy season the lowest pressure apparently does not coincide with the centre of the wind circulation, but is at some little distance to the south of the centre of the wind circulation. There are, therefore, three or four important points in which the cyclonic storms of the rains differ widely from the cyclones of the transition periods. They are :—

First.—In the cyclonic storms of the rains the main strength of the wind is confined to the southern and south-eastern quadrant and in some cases (as in the present) winds are feeble in force for considerable distances round the centre of the storm.

Second.—The absence of the central calm area in cyclonic storms of the rains which exists in the larger cyclonic storms of the transition periods in the Bay of Bengal, which, for convenience, are called below, true cyclones.

Third.—That with almost equal wind force, the differences of pressure from the outer area to the centre of the storm in the case of the cyclonic storms of the rains are very much smaller than in the case of the true cyclones.

Fourth.—The lowest pressure in the cyclones of the transition periods practically coincides with the centre of the storm and of the wind circulation, while in many storms of the rains the lowest pressure is many miles south of the centre of the wind circulation. It will be shown later on that, in the storm now being discussed, the lowest pressure was at one time, at least, 50 miles south of the centre of circulation of winds.

Taking up first the fact observed that there were light winds near the centre of the storm, while the heavy winds were many miles to the south of the centre, one theory which might be advanced to account for these strong winds would be to suppose they were simply winds of indraught towards the storm centre, and therefore not part of the cyclonic circulation proper. This theory necessitates an exceedingly strong inrush towards the centre, exerted only perhaps 50 or 100 miles south of the centre. It would certainly be expected that the indraught would be greater at places near the centre than at those considerably distant from it, but this is not found to be the case. Again, if there be this enormous indraught towards the storm centre, why is it that the indraught is entirely confined to one quadrant of the storm, and why do not almost equally strong winds of indraught prevail to the east, west and north of the storm? As a matter of fact, they do not exist, and thus it would appear that the theory that these strong south-westerly winds are merely winds of indraught cannot be substantiated, and therefore it is probable, if not certain, that they form a part of the true circulation of the cyclonic storms.

The next problem which at once suggests itself if this view be accepted, is in what manner does the momentum of these winds expend itself, or where do these very powerful winds disappear in their spiral progress towards the storm centre?

One other point may, however, be taken up before this question is discussed. The work which has been done during the past few years on the subject of cyclones and cyclonic storms has apparently proved that some storms are confined practically entirely to the lower layers of the atmosphere, and are thus entirely broken up and disintegrated when in their course they come in contact with even low ranges of hills. Other storms apparently extend to great heights in the atmosphere, and such storms pass over low ranges of hills in their paths almost unchanged in intensity, and the direction of their movement is quite unaffected by such obstacles. The storms which belong to the first class are usually the violent cyclones of the transition periods, while the storms of the second class are those usually of the rainy season, which frequently travel over paths 1,000 and 1,500 miles in length over a land surface, surmounting all obstacles in their way, and indeed travelling quite unbroken from one side of India to another. The storm under review was undoubtedly one of the second class, where the cyclonic circulation extended high up into the atmosphere, for in its inland passage it encountered the hills stretching from the Hazaribagh to the Monghyr districts, which are generally of moderate elevation, ranging perhaps up to 2,000 feet, and though it was delayed in its progress by their action, it was able to surmount the hills with ease, and afterwards appeared near Patna quite unbroken, and with a barometric depression almost equal to that which it had shown in its most intense stage. The direction of the movement of the storm was also practically quite unaffected by the action of these hills, both of which facts prove the storm to have been one which extended well into the upper layers of the atmosphere.

Further, it must be remembered that briefly and popularly stated, so far as is at present known, the commencement of a cyclonic storm usually occurs at a position where light variable winds are blowing, where pressure is relatively low, and where for some cause or other, there is a steady ascensional air current. Moist winds are then drawn in towards the centre, following a spiral course, the direction of the revolution or circulation obeying well known laws. From the precipitation of rain in enormous quantities due to the ascension of the moist wind drawn in towards the centre, sufficient energy is liberated to generate a powerful circulation of winds, and to account for all the phenomena of cyclones.

If it be supposed, in the first instance, that the ascending column of air forms in a comparatively still atmosphere, as is the case during the transition periods, or from the middle of April to the end of May, and during October, it could naturally be imagined that the ascending air column will be almost perpendicular. Round this perpendicular axis winds will blow in, as explained before, on all sides, rainfall will commence in the ascending air column and will increase in heaviness as the volume of moist winds drawn in becomes larger, and a cyclone will be gradually formed in which the greatest force of the winds will be in immediate proximity to the central calm, while the less violent winds will be at greater distances from the centre. It may also be assumed with probable truth that the plane of revolution of the winds will be nearly at right angles to the central calm. In such a storm also it is clear that as the ascending air column is nearly perpendicular, the lowest pressure in the storm will be nearly coincident with the centre of the storm, or nearly if not quite in the central calm. As stated previously, this last is in fact a feature which is generally observed to occur in the fierce cyclones of the transition periods, and in these also the wind velocity is approximately equal in all quadrants of the storm, at all events in the area in close proximity to the centre. These storms are also those which are mainly confined to the lower levels of the atmosphere.

The case is however different in one of the cyclonic storms of the rains, which have been proved to extend up to very high levels, as they pass over hills of 2,000 and 3,000 feet high with little or no change of intensity. In the rains these storms are formed in the advancing monsoon current, which roughly moves from south to north. The fact of there being a monsoon current blowing from the equator towards Northern India necessitates the existence of an anti-monsoon current, above the monsoon current, blowing from roughly the opposite direction, that is, in the south-west monsoon, the anti-monsoon current will undoubtedly have a southerly component. The upper layers of the under or south-west monsoon current will, therefore, be exposed to the action or friction of the lower layers of the anti-monsoon current, which will be moving in an opposite direction, or, in other words, the upper layers of the south-west monsoon current will almost certainly be retarded to some extent, and will be moving at a slower rate than those nearer the surface of the earth.

Take the case of the axis or ascending air column of a cyclonic storm of the rainy season. It may in the first instance be formed nearly perpendicular to the surface of the earth; but it may or may not reach fully to the earth's surface on the one side, and to the upper layer of the monsoon current on the other. This axis is formed in a current of which the lower layers are probably moving towards the north more rapidly than the upper layers. Hence after its formation there will always be a tendency for the upper part of the axis to be left behind the lower part of the axis, or for the axis to be inclined towards the south, and for the lower end of the axis to be shifted to the north, and perhaps even bent up from the earth's surface or away from its original position. Also if the storm is in existence for some days in a feeble form, this tendency may become more and more pronounced, and the axis may after some time be considerably bent from the vertical and be also curved, the upper end pointing towards the south.

The cyclonic circulation of winds accompanying the central ascending air column of the storm will probably continue to rotate, roughly speaking, at right angles to this axis. The result which would follow from this is clear. There will be a position on the side of the inclination of the axis where the wind circulation will reach the surface of the ground, but every other part of the circumference of the storm will be raised to a considerable height above the ground. If the axis be bent to the south or south-east, then the only part of the actual cyclonic wind circulation which will reach the surface will be the westerly, west-south-westerly and south-westerly winds. All other quadrants of the strong winds forming part of the wind circulation will be so far above the level of the ground as to be quite imperceptible to all meteorological wind recording instruments. From this it also follows that the actual central calm, if such exists, in the storms of the rains would not be felt on the surface of the earth. For with only the southern edge of the plane of rotating winds touching the surface, while the axis of the storm is pointing southwards, the lower end of the axis, *i.e.*, the central calm would probably not reach to the surface of the ground at all; and thus could not be observed even though it existed.

Underneath the plane of the rapidly moving circulation of winds, which would form the base of the actual storm area, and which near the centre, and at some distance from it, would be considerably above the surface of the ground, there would also probably be a subsidiary feeble circulation of winds similar in direction to the strong circulation obtaining above, which feeble circulation however would be more of the nature of an eddy or eddies than of a true cyclonic circulation.

Under the conditions noted above, therefore, the only position in which strong winds would be experienced in the storm would be in the southern quadrant; and if the axis of the storm did not quite reach to the ground, as would appear to be quite possible considering the nature of the formation of the storm, the strong W.-S.-W. and S.-W. winds would only be felt at some considerable distance from the storm centre (as judged by the subsidiary circulation or eddy) but might from this point extend southwards for a long distance from the storm centre itself, while for a considerable distance round it, there would be an area of light winds in which a feeble partial and imperfectly developed cyclonic circulation of winds would be expected. Further, if the central axis of the storm or the position of ascensional currents be bent towards the south, and therefore away from the centre of the wind circulation, as it appears near the surface of the earth, it is almost certain that the lowest barometric pressure would not coincide with the centre of the wind circulation, and that if the storm were moving in a northerly course, the lowest barometric pressure would be recorded some considerable time after the centre of the storm, as judged by the wind circulation, had passed northwards, while also the area of barometric depression instead of exhibiting a sharply defined and rather deep low pressure centre would show only a more or less diffused central depression of no great intensity.

Thus it will be seen that, granting only the probable assumption that the central axis of a cyclonic storm may not always be perpendicular, but sometimes be inclined, and in the case under discussion, towards the south, it is possible to account for the great differences between the cyclones of the transition periods and the storms of the rains as laid down under the four heads on page 124. It will also be seen that an extension of the argument and the acceptance of the possibility of the axis being inclined in other directions than towards the south would account for the main force of the winds being found in any quadrant of the storm whatever, as in the N.-E. quadrant, as is found to be the case by Mr. Eliot in storms approaching the Coromandel coast. The force being in the northern half of the storm could of course be accounted for by an inclination of the storm's axis towards the north the force being in the N.-E. quadrant could be accounted for by the inclination of the axis towards the N.-E. and so on. The discussion of the whole question would however occupy more space than can be given to it here.

These conclusions, which are deduced from our knowledge of the general conditions of cyclonic storm formation, and of the general meteorological conditions during the south-west monsoon, agree with the actual facts which have already been described as happening in the cyclonic storm under discussion. There was the irregular cyclonic circulation of light winds under the central parts of the storm accompanied by a most violent circulation in the clouds above these light winds, this irregular circulation appeared also to shift its position like an eddy, as for instance on the 22nd, when near Saugor Island; and second, the sudden change from these light winds to winds of hurricane force from W.-S.-W. and S.-W., which violent winds, however, did not extend to any considerable distance either to east or west of the south of the storm, but which extended to a long distance in the southerly direction. Here is also the entire absence of a calm centre, and finally there is the fact that the lowest barometric pressure was recorded several hours (10 to 14) after the storm centre as judged by the winds had passed. This last fact will again be referred to in the next section under discussion. This phenomenon of the barometric minimum being at a distance from the centre of wind circulation is a common character of cyclonic storms. The whole of the characters just enumerated as pointed out previously are not isolated ones, but are common to many cyclonic storms of the rains, and the above explanation is, therefore, suggested as accounting for these phenomena.

One point more may be referred to, which is, that as the storm travelled inland, the area of strong winds appeared to close up from the south towards the centre as shown previously. This may perhaps be accounted for on the supposition that as the storm commenced to pass over the land surface, it began to experience more friction than over the sea surface. The friction would perhaps be greater over the area where the winds were strongest, *i.e.*, over the southern quadrant, than over the area of light winds, and thus the southern quadrant of the storm would be subject to a kind of dragging action. This would perhaps tend to make the plane of the rotating winds more horizontal than it had been, and if so would show the apparent closing up of the strong winds towards the centre. At the same time it would tend to make the storm axis gradually assume a more perpendicular position in its inland advance, *i.e.*, to bring the minimum pressure gradually nearer to the centre of wind circulation, and this also appears to have been the case in this storm.

Discussion of the pressure distribution over the storm area during the formation of the storm, and for the first two or three days of its existence.

In the previous chapter, and also in the detailed description of the daily meteorology it has been mentioned that the storm centre as judged by the wind circulation, was considerably to the north of the barometric minimum. In order to prove this point, which is an important one when viewed in the light of the previous discussion, it is desirable that the distribution of pressure should be carefully worked out.

The pressure distribution of this storm in its path from the 21st to the 24th of August can be conclusively proved by the numerous barometric observations taken at Saugor Island, and from the autographic records of pressure which are kept at the Calcutta (Alipore) Observatory.

The pressures reduced to 32° and sea level at various hours from the 20th to the 24th August are given for Saugor Island in the first table; while the hourly pressures at the Alipore Observatory are given for the days, 22nd to 24th August, in the second table.

SAUGOR ISLAND.

Barometric readings corrected and reduced to 32° Fahr. and also to sea level from 20th to 25th August 1888.

Date.	Hours	1	2	3	4	5	6	7	8	9	10	11	12	12½
1888.														
August 20th . .	A. M. .	...	...		29·667	...	...	...	29·587	...	29 687	..	...	...
	P. M. .	...	...	...	·616	...	...	...	...	...	705	..	. .	...
Do. 21st .	A. M. .	...	.	..	617	..	...	...	·672	...	·681	...	...	.
	P. M. .	..	.	...	·500	...	...	...	·531	...	·575		...	..
Do. 22nd . .	A. M. .	...	...	..	·523	. .	...	...	·530	...	·512	...	..	...
	P. M. .	29·54	...	.	·399	. .	...	.	...	...	·460	...	29 567	...
Do. 23rd . .	A. M. .	.	...	..	·421	...	...	...	444	...	·440	...	.	.
	P. M. .	.	...		·383	...	...	. .	.	..	·475	...	·463	29·470
Do. 24th . .	A. M. .	·485	29·471	29·481	·438	29·476	29·499	29 523	·543	29·571	·583	29·576	·561	...
	P. M. .	·532	·533	·535	524	·536	·560	571	...	...	·623	...	...	..
Do. 25th . .	A. M. .	·624	...	...	595	...	...	·664	·663	...	·699	...	...	..
	P. M. .	..	...	...	...	..	...	...	...	...	...	...	...	...

CALCUTTA (ALIPORE).

Barometric readings corrected and reduced to 32° Fahr. and also to sea level from 22nd to 24th August 1888.

Date.	Hours.	1	2	3	4	5	6	7	8	9	10	11	12
1888.													
August 22nd . . .	A. M.	29·570	29·544	29·521	29·530	29·522	29·539	29·543	29·551	29·557	29·552	29·543	29·529
	P. M.	·482	·456	·438	·435	·432	·445	·458	·484	·493	·500	·484	·463
Do. 23rd . .	A. M.	·460	·440	·417	·419	·392	·389	·402	·408	·412	·402	·391	·379
	P. M.	·351	·342	·324	·325	·328	·345	·348	·380	·400	·398	·388	·383
Do. 24th . . .	A. M.	·368	·365	·336	·333	·309	·306	·333	·401	·419	·435	·455	·455
	P. M.	·443	·450	·444	·456	·453	·467	·500	·542	·565	·576	·579	·578

The observations taken at Saugor Island clearly show that there was no serious fall of pressure on August 20th; but that on the early morning of the 21st, a fall had commenced, for at 4 A.M. pressure was lower than on the previous day at the same hour by 0·05 inch, which fall had increased by 4 P. M. to 0·116 inch, and by 10 P.M. to 0·130 inch. Comparing the pressures hour by hour on the 22nd with the corresponding hours of the 21st, and allowing for the daily barometric tides, it will be found that the lowest pressure recorded at Saugor Island was 29·440 inches at 10 A.M. of the 23rd, after which it began steadily to rise. The actual minimum was, however, recorded at 4 P.M. of the 23rd, but when the usual daily fall is allowed for, this pressure appears higher than that at 10 A.M.

The actual storm centre, as indicated by the wind circulation, must have passed to the east and north-east of Saugor Island sometime during the afternoon or evening of the 22nd, and at 10 A.M. of the 23rd it was certainly 50 miles to the north-east of that station, and in point of time the barometric minimum passed Saugor Island at least 12—14 hours after the centre of the wind circulation.

In the case of Calcutta also the pressures recorded began to show the influence of the storm from the early morning of the 22nd, from which time an almost steady fall of pressure took place, which continued up to 6 A.M. of the 24th, when the lowest pressure 29·306 inches was recorded, after which a rather rapid rise set in, and during the following 12 hours a rise of 0·16 inch was recorded, and in 18 hours a rise of 0·272 inch. Even taking into consideration the diurnal oscillation of the barometer, it is found that the lowest pressures which were recorded at about 5 to 6 A.M. nearly coincided with the actual minimum pressure of the storm, and as the centre of the storm determined from the wind circulation, had passed close to Calcutta on the previous evening about 7 o'clock, it is clear that the barometric minimum was about 10 or 11 hours behind the centre of the storm as ordinarily defined, while on the previous day the barometric minimum had been 12 to 14 hours behind the centre of circulation of the winds. It may therefore be noted that at this time there was a smaller interval below the two centres (*i.e.*, of winds and of pressure) than there was when the storm was near Saugor Island.

Another point which deserves mention is the comparatively shallow nature of the depression, when the great velocity of the winds in the southren quadrant of the storm is considered. The actual minimum pressure in the storm was certainly never lower than 29·25 inches. Saugor Island, Calcutta and Kishnaghur observatories were all close to the track of the storm centre, and they all agree well as to the pressures. The lowest pressure recorded was 29·306 inches at Calcutta at 6 A.M. on the 24th. Thus at no time did the pressures recorded fall more than about a quarter to a third of an inch below the normal pressure for the period. This pressure may be contrasted with that recorded in the cyclone of September 1885, at False Point, when the barometer fell to 27·135 inches, or about two and a half inches below the normal.

SHORT DESCRIPTION OF THE RAINFALL ACCOMPANYING THE STORM AND OF ITS DISTRIBUTION.

In the detailed discussion of the daily weather experienced during the formation and advance of the storm, mention has been made of the extreme heaviness of the rainfall, and it will be remembered that in several instances falls of 10 and 15 inches, within 24 hours, were recorded. The figures given in the daily meteorological tables in some cases differ slightly from those given in the rainfall tables, from the fact that the hours of observations for the two sets of data differed. Thus while from 8 A.M. of one day to 8 A.M. of the next, one fall may have been reported, from 6 P.M. of the first day to 6 P.M. of the next day (which hour was in 1888 the time for the record of rainfall at the numerous rainfall recording stations in Bengal) may give a totally different amount of rain. Taking up the usual rainfall figures measured in 1888 at 6 P.M. for brief discussion, the falls on August 21st, the first day of the formation of the storm, were light only, and there were only a few stations which showed more than 2 inches. On the 22nd the falls had increased rather rapidly in heaviness; Dharamsala and Kendrapara in the Cuttack district each received more than 7 inches; Salipore and Jagatsingpore received 5 inches; Chandbali, Cuttack and False Point more than 4 inches, and so on. The heavy falls were thus mainly confined to Orissa to the south-west of the storm centre. On the 23rd, when the centre was near Calcutta, the falls increased in heaviness in the Midnapore district, at Saugor Island, &c. On that day Contai recorded 6·33 inches, False Point, Balasore, Cuttack, and Kendrapara from 5 to 6 inches, and Dharamsala, Bhuddruck, Sorah, Jellasore and Saugor Island between 4 and 5 inches. Again the area of heavy rainfall was to the south and south-west of the storm.

On the 24th when the storm centre was near Kishnaghur, the falls became exceptionally heavy over the 24-Pergunnahs, Hooghly and Howrah districts; while the falls in the Midnapore district and in Orissa were not quite so heavy. On that day Oolooberia reported the excessive fall of 15·42 inches; Dum-Dum, one of 12·36 inches; Howrah, one of 11·66 inches; Saugor Island, 11·14 inches, and Calcutta, 10·19 inches; while very numerous stations received falls of 4 and 5 inches, and upwards. On that day, therefore, the heaviest falls were to the south of the centre.

On the 25th the falls were not so excessive as they had been on the 24th; but the decidedly heavy rainfall covered a wider area, and falls of 2 and 3 inches, and in some cases of 4 and 5 inches, were common in the Burdwan, Bankoora, Nuddea, Chittagong, Backergunge, and other districts. On that day therefore it would appear that behind the storm a heavy wave of moisture-laden winds was beginning to pass generally over the south-east of the Province.

On the 26th the heavy falls were principally confined to the Sonthal Pergunnahs, South Bhagalpur, Monghyr, Patna, and Gya districts, and the following stations reported amounts of from 4 to 6 inches: Arrah, Nowada, Pakri-Barawan, Behar, Barrh; Beguserai, Jamui, Sheikpura, Kolgong, Rajmehal, and Giridi. So that on that day when the storm was in the Sonthal Pergunnahs, the heavy falls were becoming more generally distributed on all sides of the centre.

On the 27th the falls were heaviest in Sarun, Shahabad, Gya, and Patna districts, when Jehanabad reported more than 9 inches, Gopalgunge, Buxar, Gya, and Arwal more than 6 inches, and a good number of stations more than 4 and 5 inches. Again, on this day, the heavy rain was received on all sides of the centre.

Between the 27th and 28th the storm was rapidly decreasing in intensity, and the rainfall in Bengal and Behar became comparatively light, and the falls reported in the North-West Provinces on these days were comparatively small.

So long, therefore, as the storm existed in anything like an influential form, it continued to give excessively heavy rain in and near its path, and the falls were particularly heavy near the centre of the track. To illustrate the rainfall statistics generally of this period, the falls from the 20th to the 28th August inclusive, the time during which the storm was in existence, have been indicated in Plate XVIII, where the areas of equal rainfall are shown by the intensity of the colouring. The areas of heaviest fall, it will be seen, correspond almost exactly with the track of the storm. Thus a fall exceeding 20 inches was recorded at Saugor Island, close to which place the storm struck the land. A rather wide belt of country, where falls exceeding 15 inches were recorded, then extends in a north and north-westerly direction, surrounded on both sides by areas where the fall varied from 10 to 15 inches, and this band stretches up past Calcutta, through Central Bengal into the Sonthal Pergunnahs, and then into Behar, ceasing however almost immediately the North-Western Provinces are entered On either side of this again the falls varied from 10 to 5 inches, and even in some cases were below 5 inches.

CONCLUDING REMARKS.

The storm which has now been discussed was undoubtedly one of those classed as "cyclonic storms of the rains," but it will be found to present some interesting features, if not any of particular novelty. It was formed close to the land, and over an area surrounded rather thickly on three sides out of four by properly equipped meteorological observatories, so that the main features of the formation of the storm can be readily traced.

The history of this storm fully bears out the condensation theory of the formation of cyclonic storms. It was formed over an area where there had been for a considerable period a persistent indication of comparatively low pressure, and over which area several smaller cyclonic storms of less importance had been formed previously. Over this area, for some days, light variable winds were reported, and probably at this time there was ascensional air motion taking place over it, but this cannot be actually proved. There is however abundant evidence of heavy rain falling over this area and to the south of it, and with the continuance of these condition the cyclonic storm was gradually developed, and rapidly increased in intensity. In its earlier passage over the land the wind circulation round the centre for a diameter of about 160 miles was light in force, but to the south of this, most violent winds of hurricane force existed, but which neither extended far to the south-east nor to the south-west of the storm centre. The transition also from the light winds to the winds of hurricane force was also almost sudden in character. The centre of the storm further, as judged by the wind circulation, was at one time many miles (at least 50 or 60) to the north of the storm centre as judged by the barometric pressures, but as the storm travelled over the land, both the violent part of the wind circulation, and also the centre of lowest pressure, closed up towards the centre of the wind circulation, and they may, when the storm reached Behar, have almost coincided with the centre of the wind circulation, but this cannot be actually proved.

In the absence of any explanation hitherto put forward for these and for certain other phenomena of the cyclonic storms of the rains, suggestions are made under the section devoted to the discussion of the distribution of the winds, &c., which it is believed may help in the solution of this problem. At all events the facts noticed in this storm may be explained by some such theory as that put forward, though it is not contended that such a theory can be proved by the examination of a single storm. But as some kind of a theory is necessary to work upon, if any advance is to be made in the subject, the theory is put forward in the hope that further work may be done to clear up the doubtful or unexplained points in such storms

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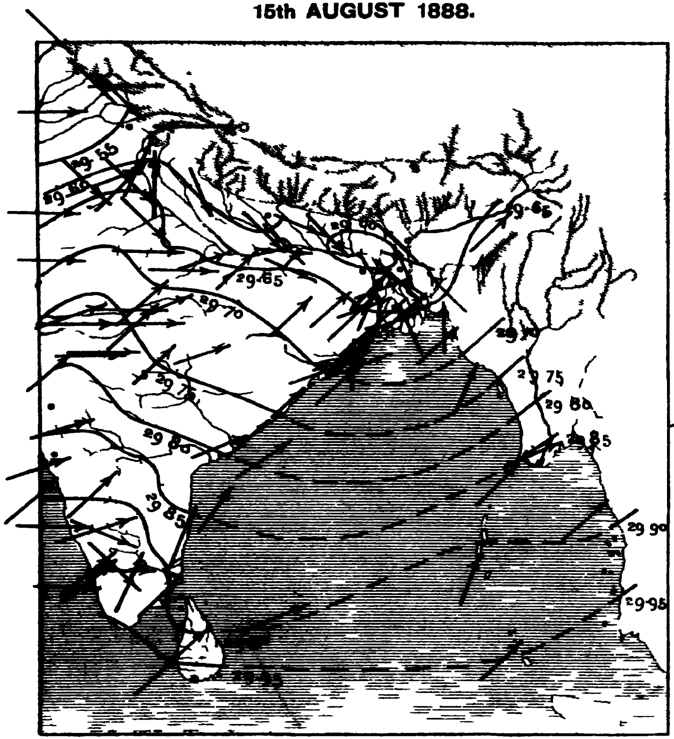
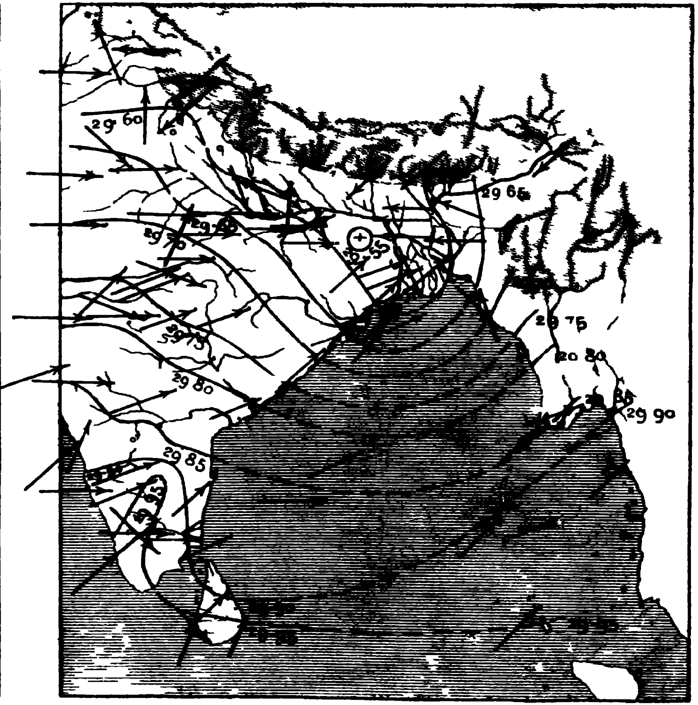
Plate VII.

15th AUGUST 1888.



16th AUGUST 1888.



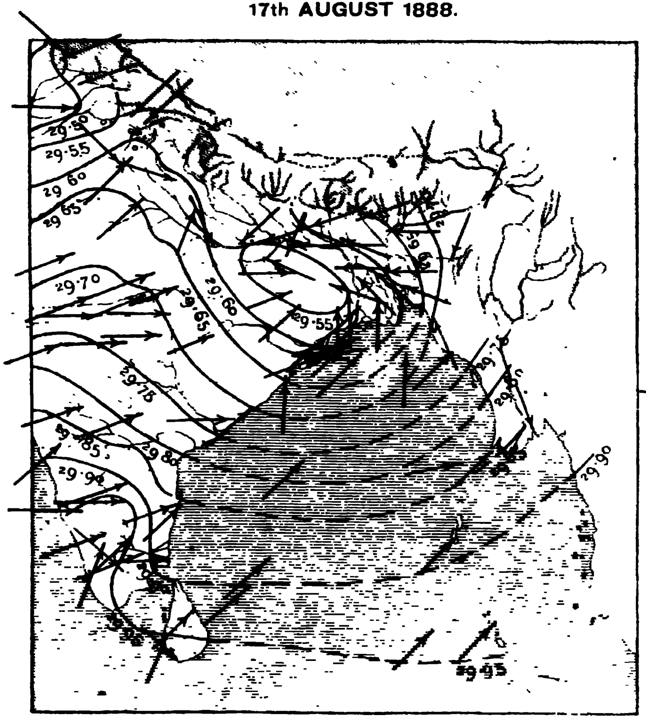
Reg No 3693 [illegible] I—19-1-96—46

Litho S I O Calcutta

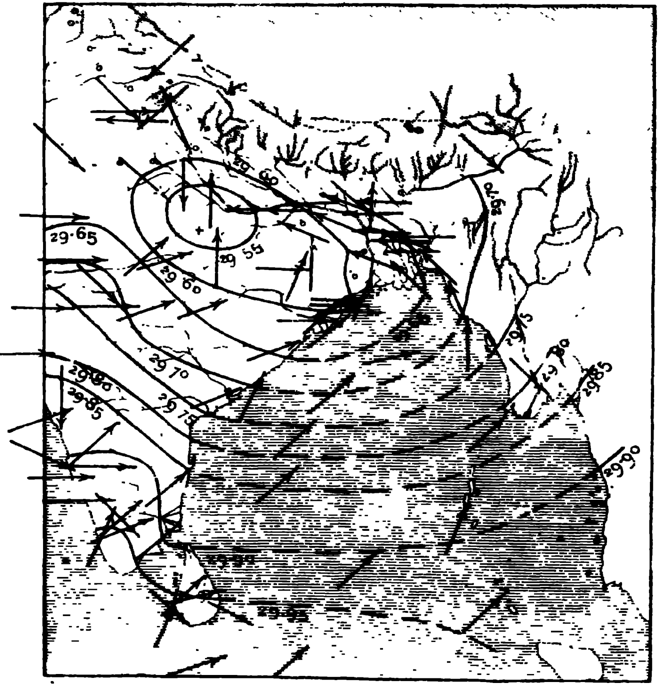
Cyclone Memoirs No. II.

Plate VIII.

17th AUGUST 1888.



18th AUGUST 1888.



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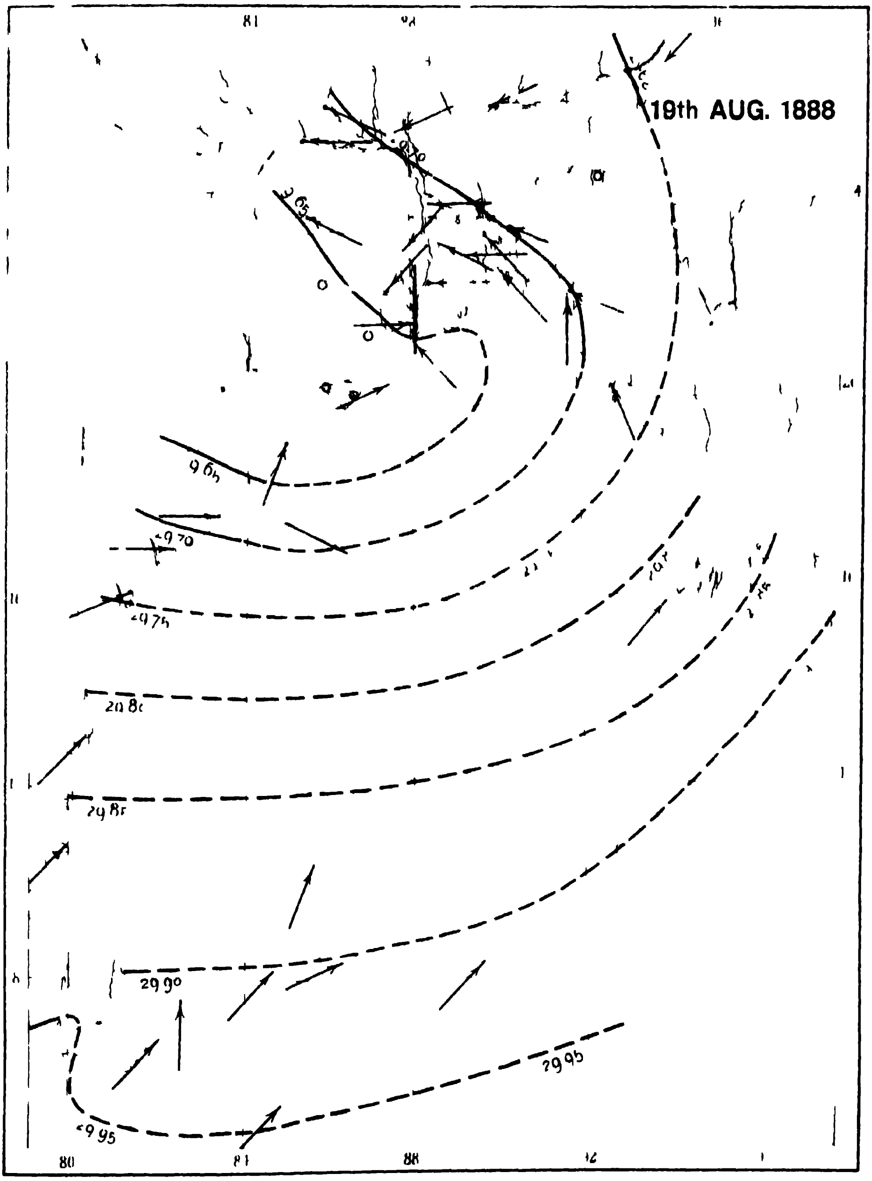
Litho S I O Calcutta

Plate IX.



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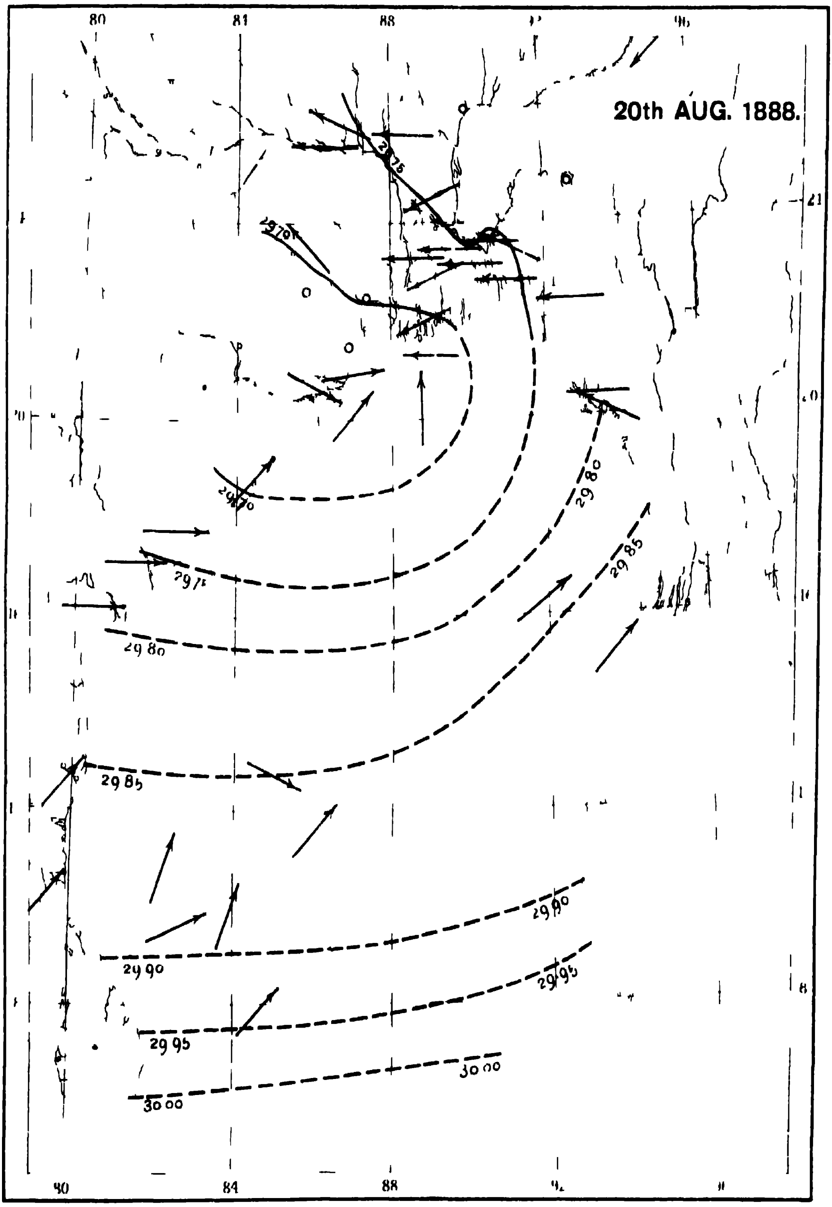

20th AUG. 1888.

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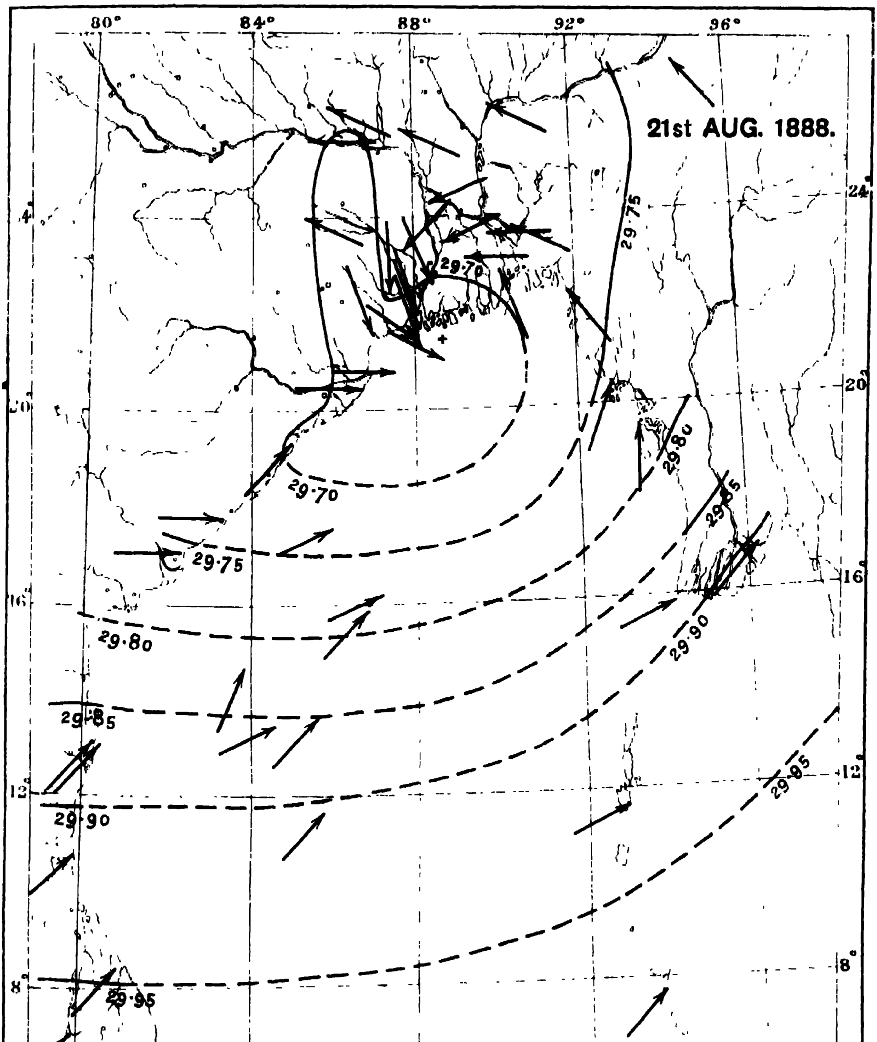
Litho S I O Calcutta

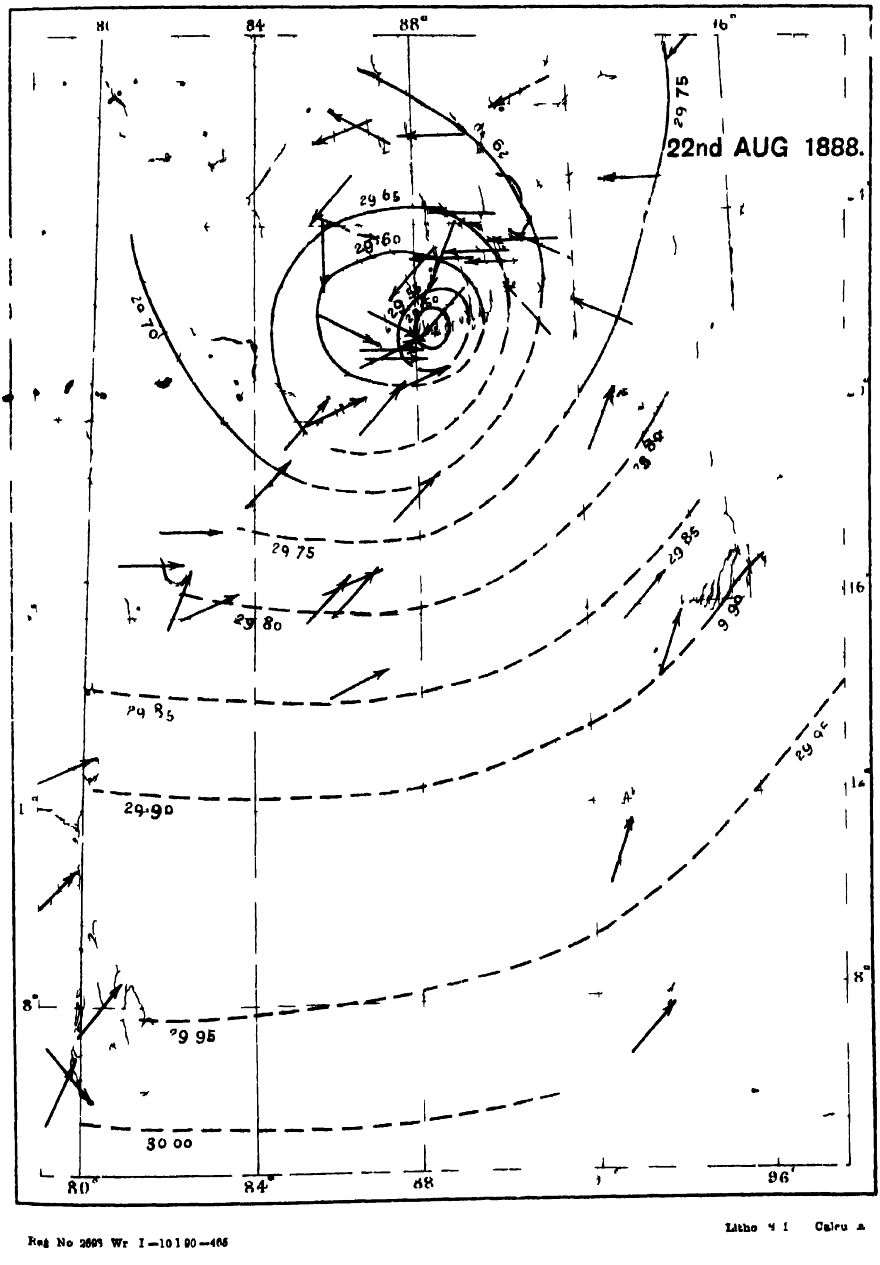
Cyclone Memoirs No. II. Plate XI.



Reg No 2693, Wr, I —10-1-90 —465

Litho., S I O Calcutta

Cyclone Memoirs No. II. Plate XII.



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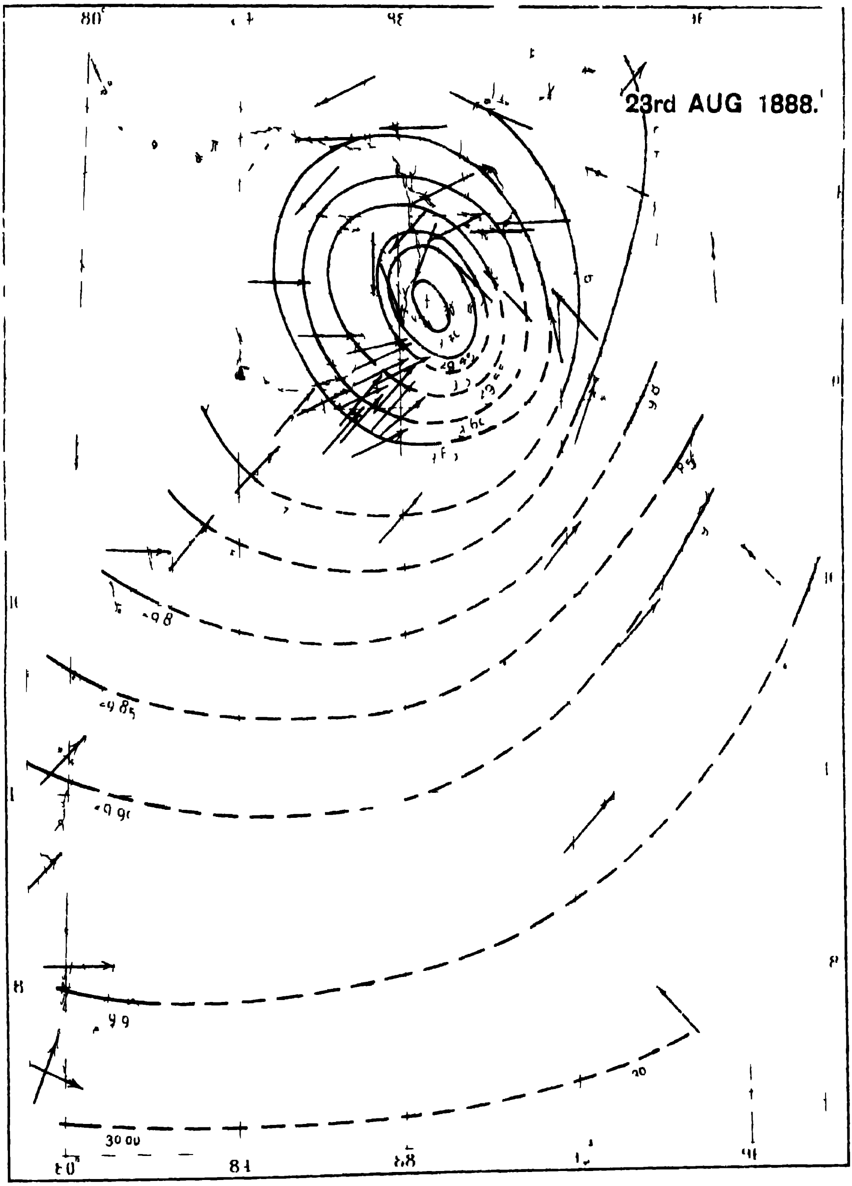
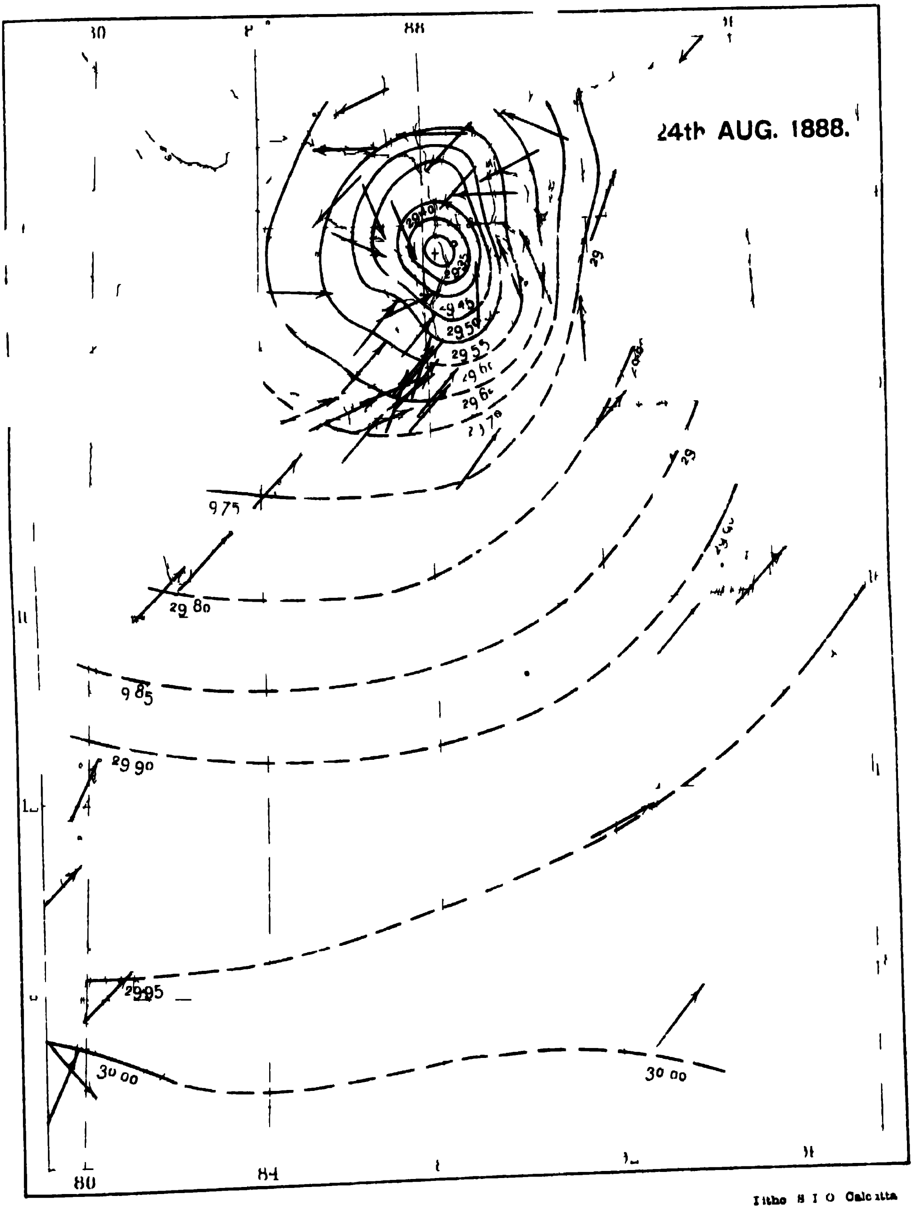
Litho. S. I. Calcutta



Litho S. I. C. Calcutta

Reg. No. 2693 Wr. I—10 1 90—465

Plate XIV



Litho S I O Calcutta

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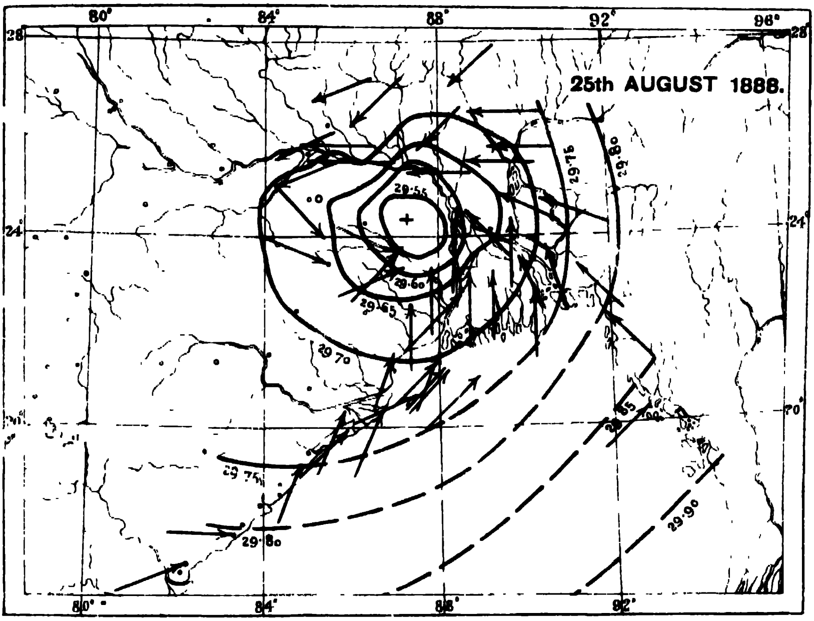
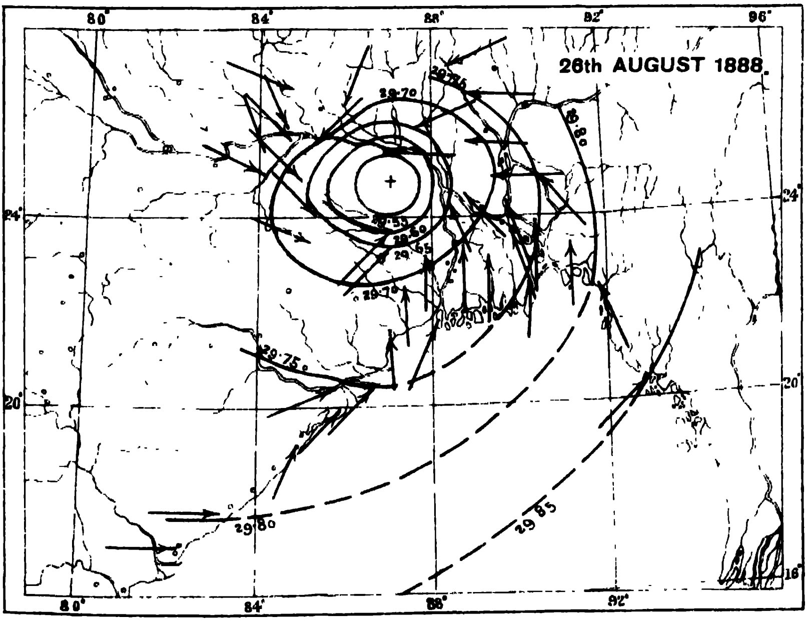
Cyclone Memoirs No. II. Plate XV.





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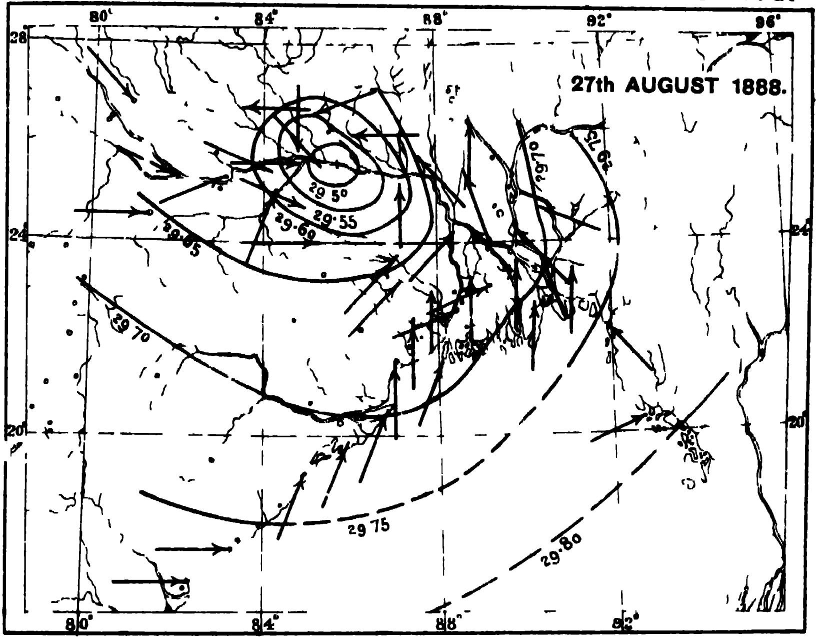
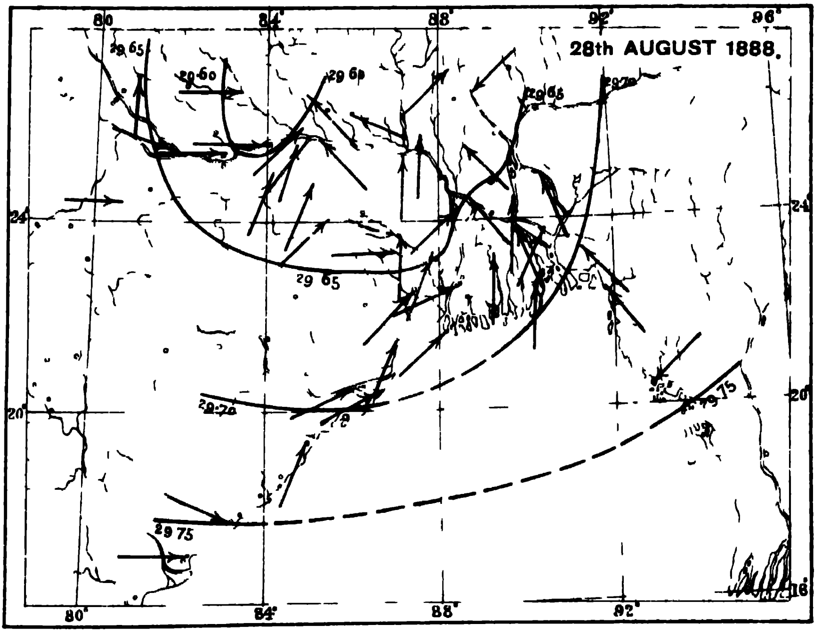
Litho. S I O Calcutta



27th AUGUST 1888.



28th AUGUST 1888.

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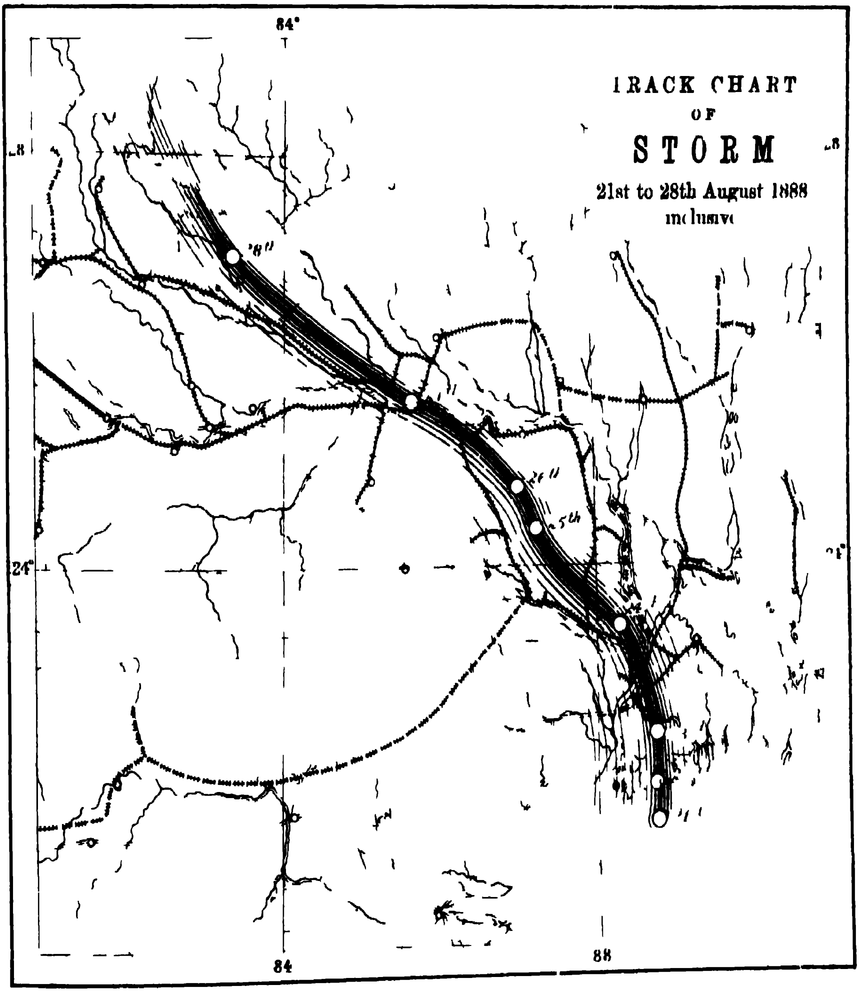
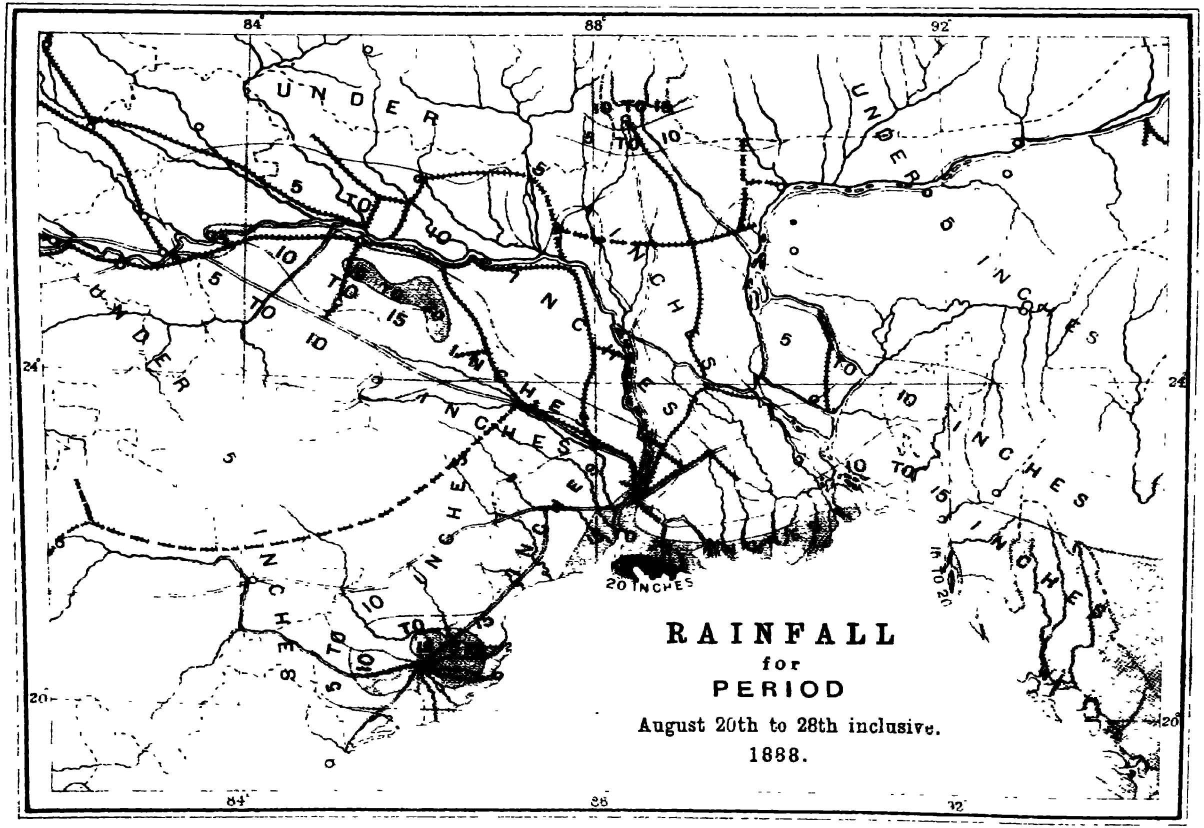
Litho S I O Calcutta



TRACK CHART OF STORM 21st to 28th August 1888 inclusive

Plate XVIII.



RAINFALL
for
PERIOD
August 20th to 28th inclusive.
1888.

Reg No 2693 Wr 1—10-1-90—486
Litho S I O [illegible]